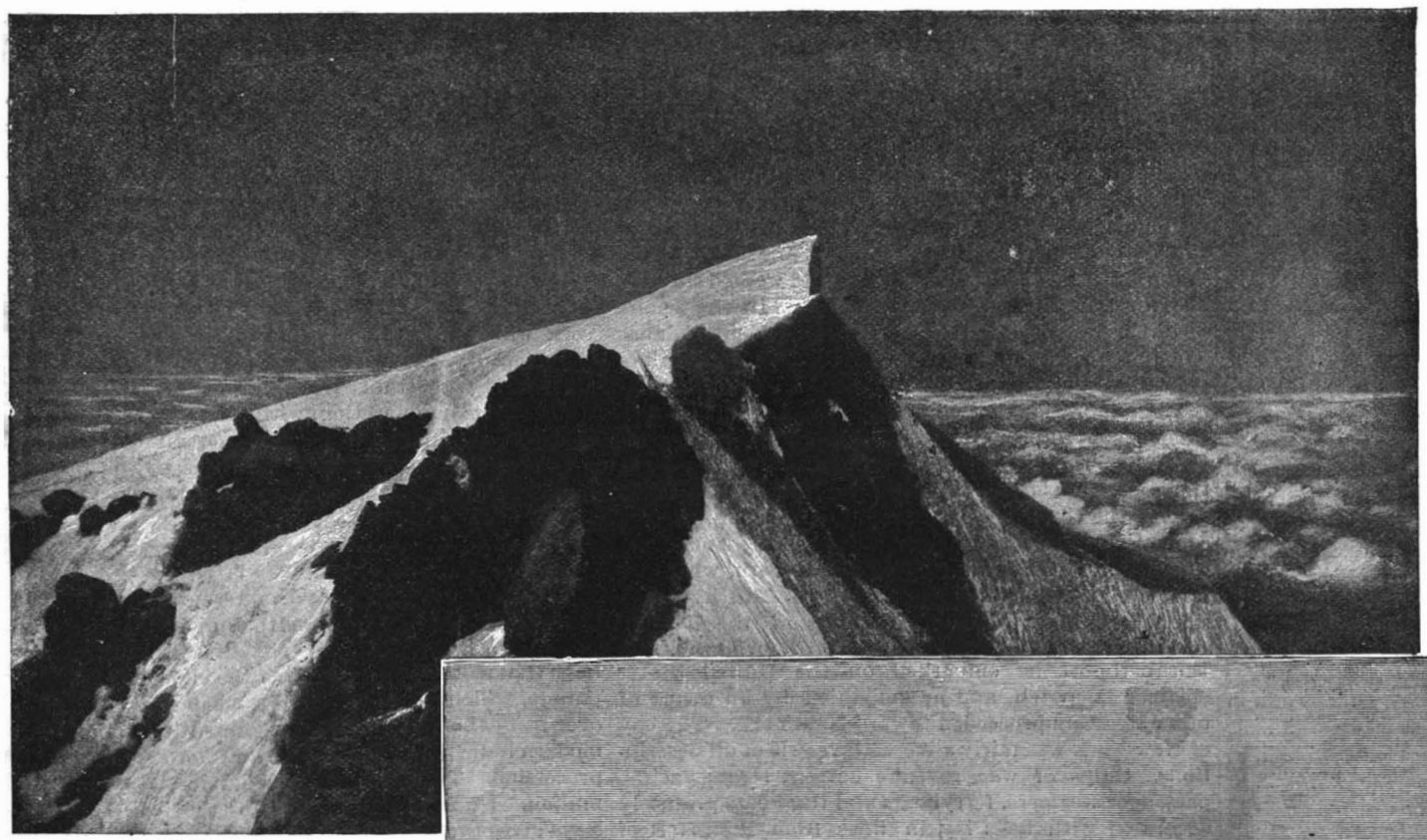
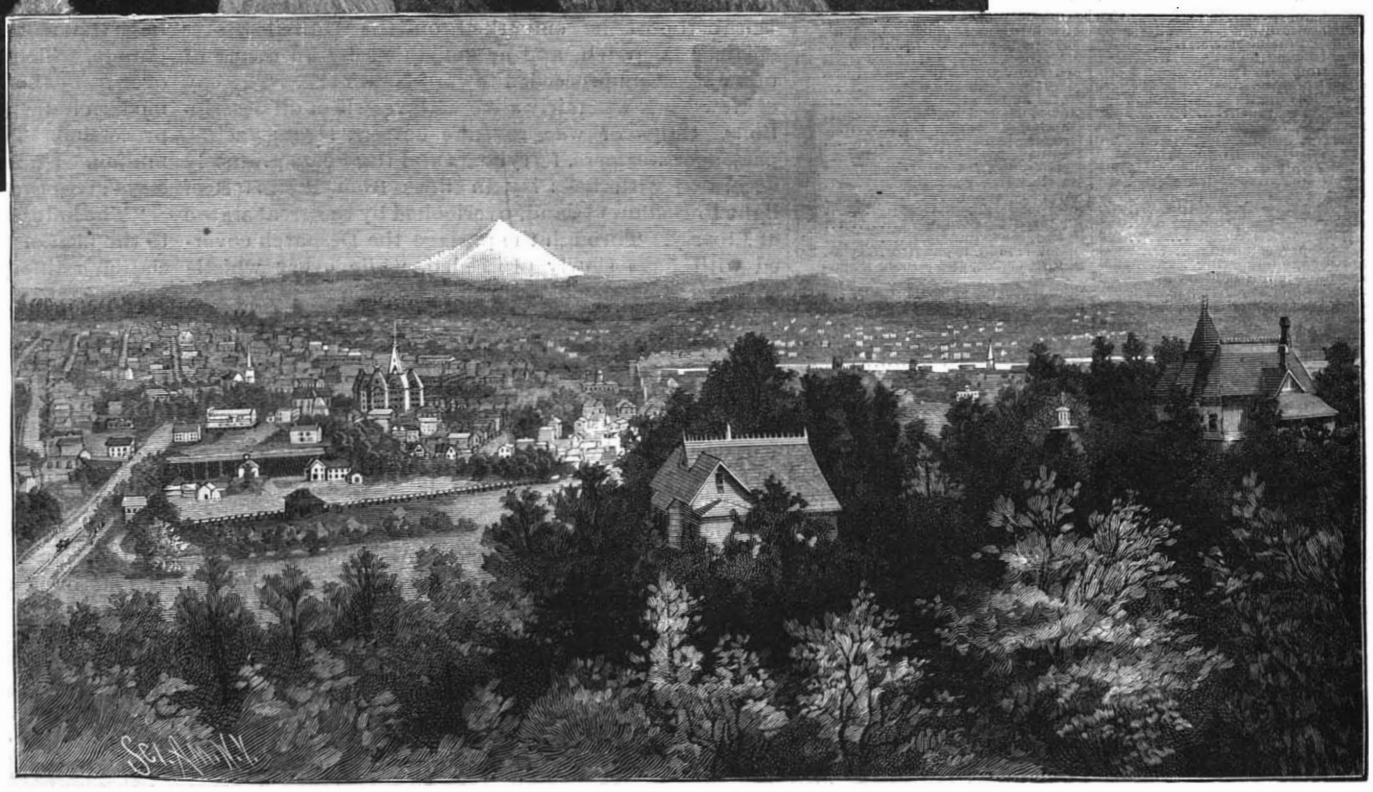
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1889, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LX.—No. 19. ESTABLISHED 1845. NEW YORK, MAY 11, 1889. $3.00 A YEAR. WEEKLY.

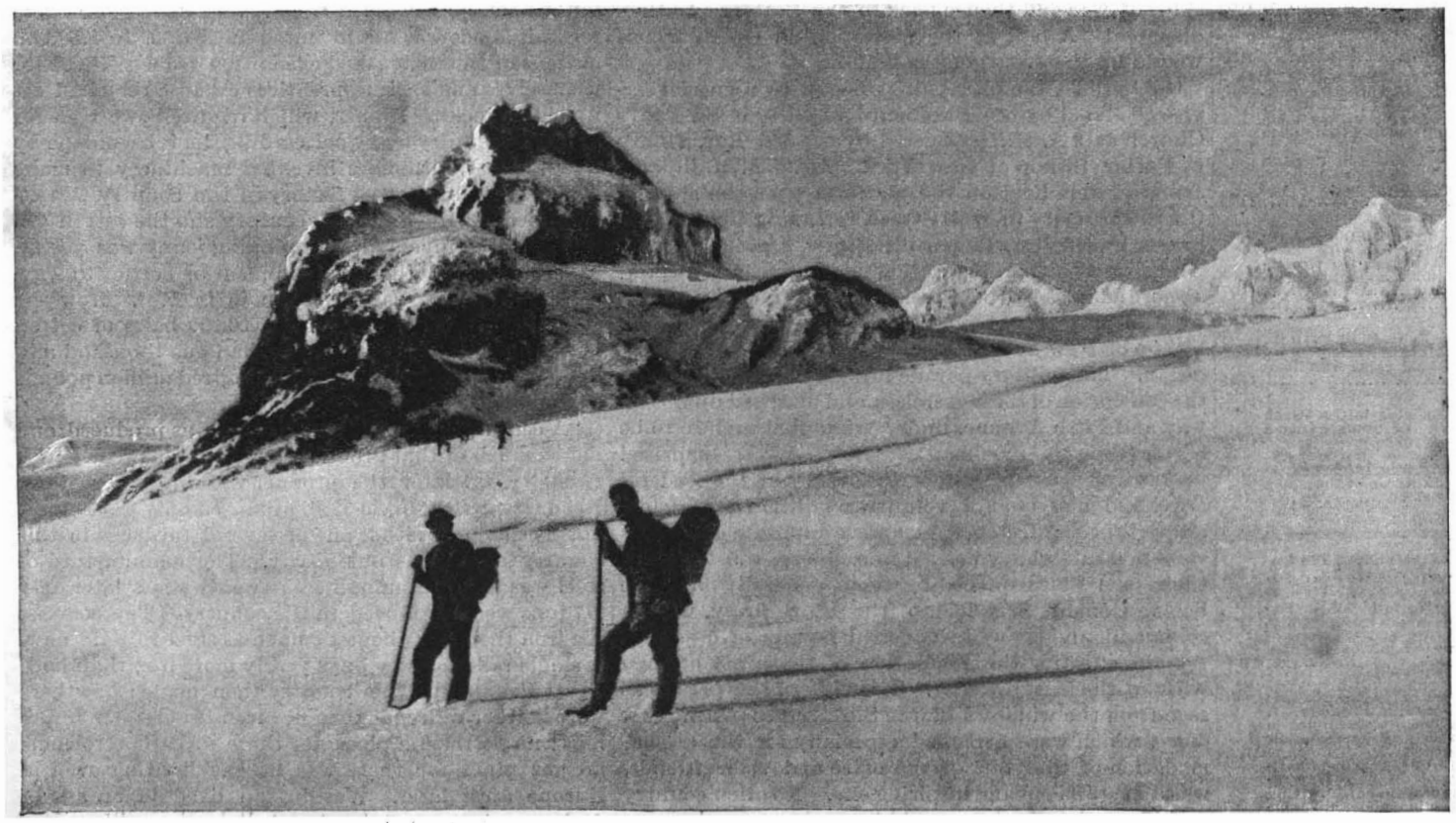




THE GRAND SCENERY OF OREGON.

By the completion of the Northern Pacific R.R., Oregon was provided with the veins and arteries necessary for full activity of life, and the State is now growing and extending and expanding its resources to a remarkable extent. Peculiar difficulties were offered to the construction of a railroad through this country, owing to the extraordinary freaks of nature in this volcanic district. The Snake River, which has cut its course through the vast plain of southeastern Washington Territory, has offered an almost impassable barrier. Its canon has a depth of 4,000 or 5,000 feet, and the cliffs are so precipitous as to baffle the efforts of the most intrepid mountaineer, while the stream itself is not navigable. Nature here was wanton and her work was on a gigantic scale. Nowhere on this continent do we find the marks of her finger more striking than here. Vast barren plains, broad navigable rivers, roaring torrents rushing through impassable canons, lofty mountains and fertile valleys on the western coast, are some of the characteristics which, from their size, appal the visitor.

East of the Cascade Mountains, Oregon is a sterile plain with no vegetation save the sage brush, the dwarf pine, and the juniper. There are a number of lakes in the southern portion, which, however, are mostly alkaline and marshy. The country is dreary and monotonous. In the region of the Columbia tributaries at the north, however, the country is more attractive, and the valleys are covered with a growth of forest trees. The woods abound in game, and the abundance of bear, deer, panthers, mountain sheep, and wolves make this region a paradise for hunters.



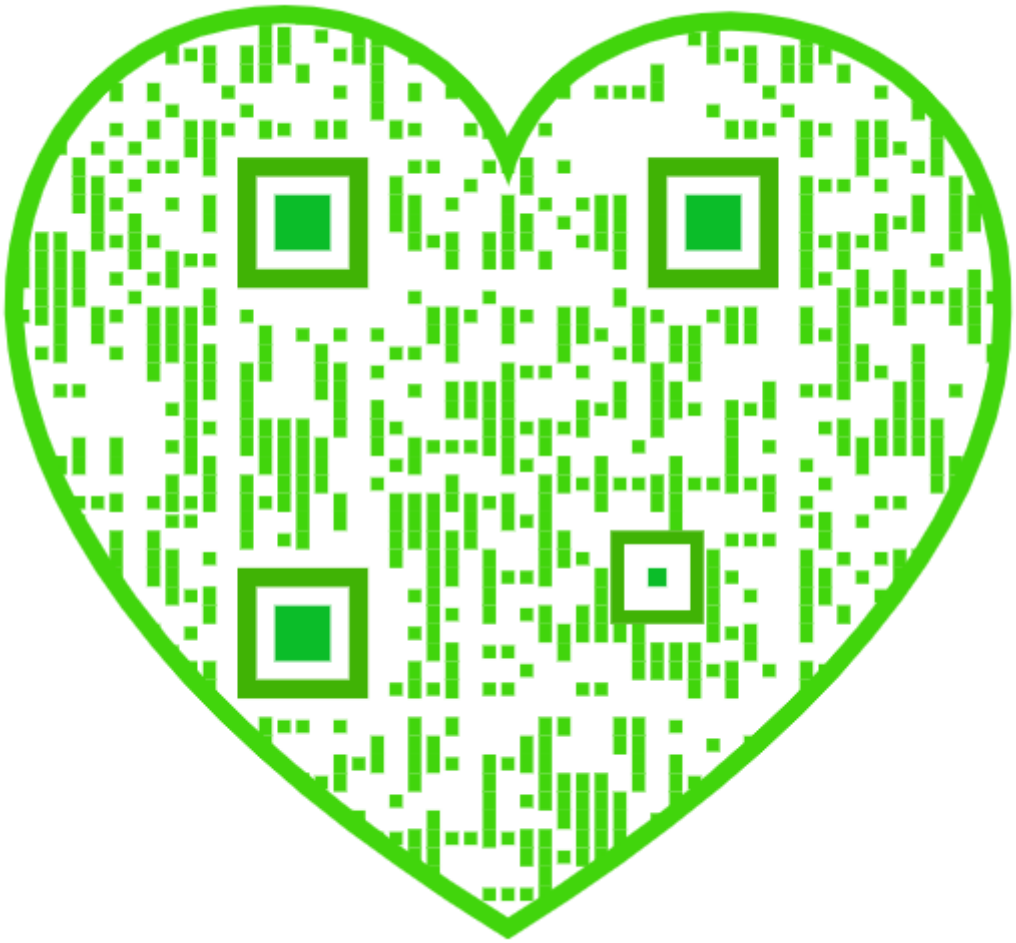
1. Summit of Mt. Hood. 2. View of Mt. Hood from Portland. 3. Ascent of Mt. Hood.

THE GRAND SCENERY OF OREGON.

The western coast is very different in physical characteristics, in climate, in fertility, and in every respect from the region described above. It possesses the traces of volcanic action found in the eastern plains, and there are evidences in the vast terraces which rise in successive levels toward the top of the lofty mountains that formerly the southern arm of Puget Sound extended as far as the lower valley of the Willamette. The climate of the coast is tempered by the warm currents of the Pacific from Japan, and the abundance of rain and the natural fertility of the soil have ren-

(*Continued on page 292.*)

© 1889 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada.....$3 00
One copy, six months, for the U. S. or Canada..... 1 50
One copy, one year, to any foreign country belonging to Postal Union, 4 00
Remit by postal or express money order.

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit £1 in current Colonial bank notes. Address
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S. and Canada. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of *seven dollars*.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes.
Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, MAY 11, 1889.

Contents.

(Illustrated articles are marked with an asterisk.)

Acrophobia 296
Appendage, caudal, in man*..... 296
Appliances, railway..... 298
Barnard, President..... 289
Baths, turpentine..... 297
Brush, fountain, Thompson's*.. 291
Business and personal..... 298
Canal, Nicaragua, rock cuttings.. 292
Cat-astrophe, recent..... 292
Centennial, Washington..... 288
Cultivator, Stagg's*..... 291
Dyestuffs, artificial organic..... 297
Engine, triple expansion*..... 294
Exhibitions, industrial, floating.. 290
Explosion of gas cylinder..... 293
Gas, natural, in Ky. and Ind..... 292
Growth, industrial, century of... 288
Heat, laws of..... 296
Hotel-keeper, scientific. 296
Inventions, engineering..... 298
Inventions, half a century of.... 290
Inventions, index of..... 299
Inventions, mechanical..... 298
Inventions, miscellaneous..... 298
Lubricants, semi-solid..... 292
Lumber supply of Puget Sound.. 290
Magnet for experimentation*.... 291
Massasauga*..... 295
Milk, preserv. by freezing..... 292
Mirror for opera glasses, Janzon's* 291
Moccasin, water*..... 295
Mt. Hood, ascent of*..... 287
Mt. Hood from Portland*..... 287
Mt. Hood, summit of*..... 287
Notes and queries..... 298
Notes, natural history 293
Oklahoma the new Eden..... 292
Oregon, scenery of*..... 287
Padlock, Brambel's*..... 291
Petroleum for manuf. purposes* 297
Rattlesnake, Eastern*..... 295
Serpents, venom., of U. S.*..... 295
Sharpener, pencil, Gem*..... 290
Sled, steam, Couniff's*..... 292
Snake, harlequin*..... 295
Spool, ribbon, typewriter, Ray's*. 290
Stamp, ticket, and punch, Dunaway's*..... 290
Step, vehicle, Marsh's*..... 290
Strap, trousers, Carter's*..... 290
Subways, elec., wires in..... 292
Tail, man with a*..... 295
Well, gas, remarkable..... 291
Wrecks, floating..... 289

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 697.

For the Week Ending May 11, 1889.

Price 10 cents. For sale by all newsdealers.

PAGE

I. CIVIL ENGINEERING.—Brake Trials in Germany.—Interesting trials of brakes by the Baden State Railways applying Kapteyn's automatic time, pressure, speed, and distance recorder in order to obtain accurate results, with elaborate tables.—2 illustrations. 11129
Hudson's Bay Railroad.—The question of the construction of the new railroad as now before the legislature of Manitoba; the financial aspects of the case..... 11132
The Water Supply for New York City.—By R. D. A. PARROTT.—An elaborate review of the water supply areas accessible to New York, with an exact statement of their population and consequent availability for a pure supply..... 11130

II. ELECTRICITY.—Resistance of Peanut Oil.—A curious experiment by Mr. J. J. P. BRUCE WARREN, suggesting the possibility of the construction of an electric thermometer depending upon the variations in the resistance of peanut oil, due to variations in its temperature..... 11132
The Silvertown Dynamo.—A dynamo recently built in England to satisfy the requirement of the Admiralty with regard to heating; exact details of the resistance of the different coils of the machine..... 11133

III. HYGIENE.—Science at Breakfast.—By JOHN MICHELS.—A review of the effects of tea and coffee upon the system, with statement of the proper method to be employed in preparing the latter beverage, and other general considerations appertaining to the subject..... 11137
Note on a Cure for Intoxication..... 11136

IV. METEOROLOGY.—How Rain is Formed.—By H. P. BLANFORD, F.R.S.—An interesting lecture by Prof. Blanford delivered before the Hythe School of Musketry; a very practical paper with illustrations drawn from common life..... 11141

V. MISCELLANEOUS.—A Nectarine Tree Changing into a Peach Tree.—A curious instance of the production of peaches from a nectarine tree, with other examples of a similar change..... 11141
Lepidochromy.—A most interesting description of a very elegant form of decorative art, which may be termed the decalcomania of butterflies' wings.—Treating of the fixing of the colors upon paper, porcelain, and glass.—7 illustrations..... 11138

VI. NAVAL ENGINEERING.—H. M. S. Edinburgh.—A description of the dimensions and armament of a new accession to the British navy; her hydraulic loading gear, and other features.—3 illustrations..... 11127

VII. PHYSICS.—Principle of Force and Demonstration of the Existence of the Atom.—By HUDSON MAXIM.—An interesting statement of the elementary conceptions of physics and the form of arguments based on 17 axioms, with answers to arguments against the existence of the physical atom..... 11136

VIII. TECHNOLOGY.—Canes and Sticks Used in the Manufacture of Walking Sticks, Umbrella Handles, etc.—By J. R. JACKSON.—A very curious contribution to technological science, describing in detail the great variety of woods used for the purpose stated, their treatment in the factory, and statistics of export..... 11139
On Wool and Fur—Their Origin, Structure, Chemical and Physical Properties, and Composition.—By WATSON SMITH.—First installment of a very exhaustive paper on the typical subject, giving a full review of the chemistry of wool, its action under different reagents, and microscopic views of the fibers as affected by different reagents.—14 illustrations..... 11133
Poto-Lithographic Transfers.—By W. T. WILKINSON.—The general principles of lithographic transfers, with details of manipulation and precautions to be taken to get good results..... 11133

THE CENTENNIAL OF THE INAUGURATION OF GEORGE WASHINGTON AS PRESIDENT OF THE UNITED STATES.

On April 23, 1789, George Washington, duly elected President of the United States, reached Elizabethtown, N. J., on his way to New York, then the Federal capital, where he was to be inaugurated first president of the new nation. A splendid barge manned by thirteen masters of ships, commanded by Capt. James Nicholson, received him and brought him through the kills and across the harbor to the foot of Wall Street. Gov. George Clinton of New York received the President-elect and escorted him to the Franklin House in the square of that name. Six days elapsed, days of great excitement for the city, then of small proportions and giving no promise of its future growth. On April 30 all the churches in the city were opened at 9 o'clock in the morning, and prayers were offered up in all for the safety of the President. About midday the procession escorting him started from Franklin Square and proceeded to the Federal State House, on the corner of Wall and Broad Streets, occupying the site of the present sub-treasury. Washington was drawn in a coach by four horses. The procession as it neared its destination halted, and the military formed a line on both sides of the street. Washington alighted and walked through the lines and entered the building. In the senate chamber he was received by Vice-President Adams. The party went out upon the balcony, and the oath of office was administered by Chancellor Livingston.

The celebration of the hundredth anniversary of this event has been brought to a most successful end in this city. The ceremonies were arranged with reference to the occurrences of one hundred years ago. The President of the United States, Benjamin Harrison, was the central figure among the participators. He came from the city of Washington by rail to Elizabeth, where he was received on the morning of April 29th by a distinguished body of representatives of the literary and official circles of New York and New Jersey. At Elizabethport he embarked on the United States steamer Despatch, and accompanied by an escort of other steamers proceeded toward New York. The bay of New York was fairly alive with vessels of all descriptions. Ships of war, revenue cutters, steam yachts, passenger steamers, ferryboats and tug boats profusely decorated with flags lay in lines from Robins Reef light to Bedlows Island, overlooked by the great statue of Liberty. Through the passage the Despatch covered with flags slowly proceeded, while every whistle blew as she passed, and the ships of war with yards manned fired the presidential salute. Off the foot of Wall Street the Despatch anchored, and the President was rowed ashore in a barge manned by a crew of ship masters from the Marine Society of the City of New York, with Capt. Ambrose Snow as coxswain. The crew that rowed General Washington to the same spot one hundred years ago were members of the same society.

On landing, the President was received by Mr. William G. Hamilton, the grandson of Alexander Hamilton, and was introduced to the Governor of the State of New York and to the mayor of the city. The fleet of naval ships meanwhile proceeded up the Hudson River to an anchorage near 50th Street, and the other vessels formed in order for the naval parade. They steamed up the East River to a floating derrick near the southern end of Blackwell's Island, rounded it, and returning went up the Hudson River and around the ships of war and thence back to the Battery and then dispersed. A ball at the Metropolitan Opera House wound up the events of the first day.

On April 30, the proceedings began by a special service attended by the President and party in St. Paul's Church at 9 A. M., conducted by the Rt. Rev. Henry C. Potter, Bishop of New York. At 10 A. M. literary exercises were held on the platform over the steps of the sub-treasury in Wall Street, including an opening prayer by the Rev. Richard S. Storrs, a poem by John Greenleaf Whittier, an oration by Chauncey S. Depew, a short address by the President, and the benediction by the Most Reverend Michael A. Corrigan, Archbishop of New York. Then the great event of the day began. The military parade formed immediately after the conclusion of these exercises, and marched up Broadway and Fifth Avenue, under triumphal arches, to be reviewed by the President at 23d Street. It comprised upward of 46,000 men, representatives of the Federal army and navy and of volunteer militia from almost all parts of the Union. A number of State governors were present. They headed in each case the troops of their own State, preceding them, generally on horse back. General Schofield, of the U. S. army, was in command, and showed wonderful powers of organization in effecting the regulation of the army of men without the least disorder. The view of this parade as seen from the windows of the SCIENTIFIC AMERICAN office, which were arranged especially for the accommodation of the staff of the office and their friends, was a magnificent and inspiring one. No other country could now show, or ever could have shown, such an assemblage, consisting of the representatives of States thousands of miles distant from each other, in the guise of purely volunteer soldiery ready for the defense of their country in any possible emergency. Another feature of the day was the profuse decoration of the city. Not only the line of march, but every portion of New York, was decorated with flags and bunting. To the east and west, and for miles north of the line of procession, nearly every house displayed flags and other emblems and drapings. On the evening of April 30, a grand dinner took place at the Metropolitan Opera House. This was the great day of the celebration, as being the anniversary of Washington's inauguration.

On May 1, the civic and industrial parade took place. It comprised about 41,000 participants, representatives of the various trades of the city, leading societies, and a large array of public school children. This was also reviewed by the President, bringing the three days' pageant to a close.

Nothing was neglected by the great metropolis to enhance the meaning of the occasion. In the public schools special attention was given to instructing the scholars in the events commemorated. In selecting participants in the ceremonies, the descendants of the old time families of New York and of personages of historical fame were chosen. Grand stands were erected for the accommodation of spectators. Taken from all points of view, it may be questioned if New York will again see the equal of this display for another century. It is strange to read the printed account of the escort of Washington, taking up about 21 lines in its enumeration, with the list of participants in the centennial parades, that was enough to fill a book of many pages. The lessons of unity, patriotism, and peace taught by the three day's ceremonies cannot be without effect.

A Century of Industrial Growth.

Among the incidents of the recent celebration in New York of the one hundredth anniversary of the inauguration of Washington, the first President, perhaps the most remarkable was the civic or industrial parade, which took place May 1, when, it is estimated, over forty thousand persons, representing the various modern industries, fell into line and formed a gigantic procession. The spectators were numbered at over one million. Under the above heading the *New York Tribune* gives the following interesting article:

"The industrial parade, marvelous as it has seemed to the men of this generation, needs for a full appreciation a different point of view. How would it have appeared to George Washington and his Revolutionary associates? What incomprehensible and incredible marvels would they have seen in its machines and inventions, its arts and tools, its princely expenditure by voluntary societies of workingmen, its mighty array of well clad, well paid, and comfortable workers? If it were possible to contrast the industries of 1789, when the world had lived and learned at least fifty-eight centuries, with those of 1889, when only one century more has been added, what a startling contrast!

"It is not possible. A new world has been created. The methods, tools, products, and artisans of a century ago in many departments have vanished as completely as if they belonged to another planet. What has become of the spinning wheel or the wooden clock? The suit of woolen cloth worn by President Washington at his address to Congress in 1789 was presented by a woolen factory only established in the preceding year, and cloth then cost $5 a yard. The people were clothed in the homespun made in every family. The power loom for knit goods was not invented until 1830. In 1789 two citizens of Norwich asked exemption from poll tax for themselves and their apprentices because they had set up eight stocking frames, which required two men for each. A century ago wool carding had been done by hand, but Whittemore invented machinery to make cards. The first carpet factory in the country was established a little later. A century ago the cotton gin had not been invented, the spinning jenny was yet an experiment, and the first shipment of cotton to England, only eight bags, was made in 1784. Now the country has raised more than 7,000,000 bales of cotton in a year, and worked up more than one thousand million pounds of cotton and four hundred million pounds of wool.

"A century ago only charcoal iron was produced, and not as much of that probably as 30,000 tons yearly; for twenty years later the product was but 53,000 tons. Even Great Britain, in 1788, produced only 68,300 tons, not as much as either one of several furnaces in this country now turns out yearly. The manufacture of steel was just beginning here; twenty years later only 917 tons were produced in the country. The coarsest pig iron then cost about as much as steel rails do now. A single railroad now buys yearly more iron than both Great Britain and this country then made; but there were neither railroads then nor iron bridges nor buildings; no petroleum pipes, for there was no petroleum; no gas pipes, for there was no gas lighting even in Europe until later. Washington lived in an age of darkness; instead of the electric light the millions had candles, costing about two cents apiece. In all the departments and applications of chemistry the century

© 1889 SCIENTIFIC AMERICAN, INC.

has simply created a new world. American pressed glass, which has completely revolutionized the supply of table and house ware, is an invention of the last sixty years. The silk manufacture has not existed in this country half a century; the paper made a hundred years ago would hardly be thought fit for use since modern methods have been invented; the only use discovered for India rubber then was to erase pencil marks; and while the town of Lynn made 100,000 pairs of boots and shoes in 1788, they were not the shoes of to-day, and the manufacture by machinery is wholly due to inventions since 1800. Sewing machines for any purpose were unknown, and salt was made by boiling sea water, though in 1787 it was first made from the springs near Syracuse at the rate of about ten bushels per day, and the cost soon fell to 50 cents per bushel.

"Farming in Washington's day knew nothing of machinery; even the first iron plow, patented in 1797, was a failure, for New Jersey farmers thought it poisoned the soil. Mowers, reapers, and harvesters began to be invented about the same time, and even the ordinary implements were such as it would not now be thought possible to use. The steamboat was practically unknown, and the railroad entirely until forty years later, and the cost of transportation by wagon confined the area of possible production with profit, as to most crops, to the margin of navigable waters. The whole nation could not produce in Washington's day as much wheat as single Territories not yet States now export each year, and when the accounts of a century ago tell of "vast quantities" exported, they really mean less in a year than the country has since moved in a single week.

"Volumes could be filled, and yet but a small part of the change in industry within the century could be mentioned. But the revolution in the condition of the laboring population has been the crowning result of all this progress. Of wages, it is enough to say that masons a century ago earned 67 cents a day in Massachusetts, carpenters 52 cents, blacksmiths 70 cents, and ordinary labor 30 cents. Food near the farms was cheap, but pork is quoted in Massachusetts at 16 cents per pound, flour at $8.16 per barrel, corn at 76 cents per bushel, and ham at 20 cents per pound. Calico cost 58 cents per yard, broadcloth $2.70, buckram 22 cents, cotton cloth 88 cents, and tow cloth 30 cents; hose cost $1.35 per pair, and "corded Nankeen breeches" $5.50; buttons from 1 to 5 shillings per dozen, shoes of lasting 84 cents per pair, and sugar from 15 to 22 cents per pound. One does not need to study such figures as these very long to discover that the world and the living of to-day were simply impossible for the working people a century ago. The whole world has changed, but nowhere has the marvelous advance been greater or for the working millions more beneficent than in these United States."

FLOATING WRECKS.

The International Maritime Conference, which will assemble at Washington in October next, among other important maatters pertaining to the saving of life on the ocean, will be called upon to consider the wisdom of dividing the Atlantic Ocean into districts and assigning them severally to the great naval powers, who will be expected to remove derelicts or wrecks which may be considered in any wise dangerous to commerce. For the past three years the Hydrographic Office of the Navy Department has been of great service to mariners by collecting information regarding derelicts, their movements, changes in character or position, by the action of the elements or other causes, and publishing the same on the first of each month in the form of a pilot chart, which also contains a large amount of other information of the greatest value to the navigator.

Subsidiary to the work of the Hydrographic Office in locating dangerous wrecks and reporting the movements of derelicts have been the operations of the naval vessels to which has been assigned the work of blowing up such of these obstructions to commerce as may be considered of a specially dangerous character. Most derelicts are lumber-laden and come from Southern ports of the United States. The Gulf Stream flowing strongly in a north-northeasterly direction, they are apt to be carried along with it until they strike the Labrador current flowing south, and then their course is reversed.

The American schooner W. L. White, abandoned off Cape Hatteras in the blizzard storm of March 13, 1888, is a case in point. She floated north with the Gulf Stream until she got into the Labrador current off the Grand Banks in the following May. Here she remained floating to and fro in the very track of many ocean steamers during the entire summer of 1888 and until October 30, when she took an easterly and then northeasterly course, and finally went ashore on the Hebrides January 25, 1889. During the cruise of this derelict, covering ten months and ten days, she must have covered a distance of at least five thousand miles.

Naval vessels frequently receive orders to look out for certain derelicts and to blow them up when found. The United States steamer Despatch, Lieutenant W. S. Cowles, though not specially adapted for this work, has done a considerable amount of it. After the great storm of March, 1888, a number of wrecks demanded immediate attention, and one of these was the bark Brimega, which had capsized off Cape May and lay bottom up inside the cape and grounded. The course pursued in blowing it up was as follows: Men from the Despatch, under command of Lieutenant McLean, got upon the hull, and with augers and axes penetrated through twenty inches of oak, and made four holes large enough to admit the torpedoes. These torpedoes consist of a cast iron shell cylindrical in form, three feet long and about a foot in diameter. There are handles on the sides, and from the head projects an iron tube, into which the electric wire passes. The tube is fitted with a plug to keep out the water, and the wire then passes through a papier-mache cylinder nearly to the nether end of the torpedo, where it is connected with a very thin platinum wire, and this again is surrounded with guncotton. Fine gunpowder is placed next to the guncotton, and above that the coarser grain, a hundred pounds of powder comprising the whole charge. When all was ready for the explosion, the men took to their boats and withdrew to a distance of from 150 to 200 feet. The officer in command of the operations paid out a wire from a reel which he held in his hand, and when the proper distance was reached he connected one end of it with a hand dynamo, which is known as the government torpedo station machine. The electric current is instantly sent into the torpedo, the platinum wire is heated to a white heat, the guncotton ignited, and the torpedoes, weighing about 325 pounds each, are instantly exploded. The wreck was broken in pieces, though subsequent explosions had to be made before the destruction was complete.

The masts of sunken vessels which extend above the surface of the water or terminate just below it are extremely dangerous to navigation, and the steamer Despatch has been frequently called upon to remove such obstructions. After proceeding to the locality indicated on the pilot chart issued by the Hydrographic Office or in special orders from the Navy Department, a survey is made and the position of the wreck determined upon as nearly as it can be from the deck of the steamer. Two boats then put out for the wreck. One carries the torpedo, with five men to handle it and six men at the oars. The other boat contains the officer in charge of the work, with a competent crew, and the apparatus for exploding the torpedoes. The steamship Eureka, which was wrecked off the Maryland capes, was found resting on the bottom. Two of her masts, which were of iron, extended above the water line, and two terminated just below it. To remove these obstructions a torpedo was let down by a guide rope to the deck of the vessel, placed against the masts, and exploded in the same manner as previously described. A conical column of water was thrown up to a distance of nearly 75 feet, and the masts were completely destroyed.

Sometimes wooden masts are found sticking out of the water and held in position by sunken wreckage. When the torpedo is set off, large pieces of the wood rise to a considerable distance in the air, seemingly whole, but as they descend they separate into a thousand pieces. On attaching the torpedo to the object to be destroyed, care has to be taken that it comes in direct contact with the object, for if any considerable amount of water is allowed to intervene, it acts as a cushion and a great deal of the force of the explosion will be lost. When sunken hulls are found, soundings are made, and if it appears that they are not covered with a sufficient depth of water to render them free from danger, torpedoes are let down with guide ropes and exploded in such a way as to destroy the hulls. This kind of work is slow and tedious, and can only be successfully carried on in a vessel like the Despatch, during fair weather and with a smooth sea. The area covered by the steamer Despatch in her cruises for derelicts is from seventy-five to a hundred miles and extends from Chesapeake Bay to Boston Harbor. The explosives used are not considered the most effective by the naval officers in charge of these operations, and they hope that guncotton or dynamite in time will be substituted for them.

Lieutenant Geo. P. Blow, now in charge of the New York branch of the Hydrographic Office, was in May, 1885, on board the United States man-of-war Pensacola, Captain Geo. Dewey. When six days out from Norfolk the floating derelict Bertha Balruhs was sighted. Upon examination she appeared to have been abandoned a long time. Her deck was level with the water, the sea was making clean breaches over her, and her sails were hanging in shreds and festoons from the yards. A guncotton torpedo was placed under the floor of the cabin, which blew off the deck house and did other damage. Another torpedo was exploded amidships, which shot the main mast up into the air like a rocket, but it settled back into its old place again, and the derelict continued to float along as before. Then the explosives were lashed to the keel of the vessel, and they shattered her so completely that in a short time she went to pieces.

The United States man-of-war Yantic has recently received orders to search out and destroy the derelict Vizenzo Perotta, which was wrecked off the capes of Virginia on September 18, 1887, and has been floating about the ocean ever since. She is loaded with lumber, has been reported eighteen times between the scene of the wreck and the coast of Cuba, and is considered a very dangerous derelict. There are nine derelicts now known to the Hydrographic Office, including the steamer Danmark, recently reported, and fifteen the names of which are not known.

Some derelicts are destroyed by collisions and others by the action of the elements, while others float a long time bottom upward, the air keeping the water from coming in and working their destruction. They are a constant menace to passing vessels, and there can be no doubt that some at least of the vessels which have gone out from port and have never been heard from were the victims of some derelict.

Information regarding the movements of derelicts and the position of various obstructions to navigation are reported to the several branch hydrographic offices which are now located at New York, Boston, Philadelphia, Baltimore, Norfolk, New Orleans, Portland, Oregon, and San Francisco, Cal. This information is sent to Washington, where the main hydrographic office is located, in charge of Lieutenant Geo. L. Dyer as hydrographer to the Bureau of Navigation. Here the information is classified and published on the first of every month in the form of a chart, upon which is also indicated the latest positions of derelicts, location of icebergs, course of ocean currents, fogs, probabilities of whirlwinds, waterspouts, and tornadoes, as well as other information. Every vessel, of whatever nationality, leaving the principal American ports is supplied with a set of charts, corrected to date, without charge.

Recently the co-operation of Captain Carbonell, the director of the newly established Marine Observatory at Havana, Cuba, has been secured, by which the Hydrographic Office will receive telegraphic information of tornadoes which may be approaching our coasts.

President Barnard, of Columbia College, N. Y.

On Saturday, April 27, at 4:15 P.M., President Barnard, of Columbia College, died. In his death a loss is inflicted not only on his college and city, but on the country at large. He ranked with the most advanced thinkers of the day, and did much to enhance the scientific standing of the United States.

Frederick Augustus Porter Barnard was born May 5, 1809, at Sheffield, Berkshire Co., Mass. He was of English ancestry. In 1828 he graduated at Yale and at once began his life work as an educator by accepting a position in the Hartford grammar school, and in 1830 became a tutor at Yale. It was soon proposed to make him professor of pure mathematics, but he was forced to decline on account of his health. In 1831 he taught in the Deaf and Dumb Asylum in Hartford, and 1832 in the corresponding institution in New York. From 1837 to 1848 he filled chairs of the natural sciences in the University of Alabama in Tuscaloosa, and after this in the University of Mississippi in Oxford. In 1856 he became president of this university. There he had as fellow professor Jefferson Davis, afterward President of the Southern Confederation. In 1854 Prof. Barnard had been admitted to the ministry of the Protestant Episcopal Church. During the war he did excellent service on the U. S. coast survey. He then became an applicant for the chair of physics in Columbia College, but was appointed president instead, succeeding Dr. Charles King. This position he accepted in May, 1864. About a year ago he resigned, but the trustees, anxious to have him complete a term of twenty-five years, delayed the acceptance of the resignation. It will be noticed that but a few days remained to complete a quarter century of devoted service to the college when he died.

His mind, of strongly scientific bent, found many outlets. In microscopy and astronomy he did excellent work. He accompanied the U. S. coast survey expedition to Labrador to witness the total eclipse of the sun in 1860. Much of his work on the coast survey was in astronomical science. He was also president of the American Microscopical Society. He was one of the original incorporators of the National Academy of Sciences, has been president of the American Association for the Advancement of Science and of the Board of Experts of the American Bureau of Mines. He was one of the U. S. commissioners to the Paris exposition of 1867, and his elaborate report on Machinery, Processes, and Products of the Industrial Arts and Exact Sciences is, at the present day, excellent reading and a standard reference. He, with Professor Guyot, was a chief editor of Johnson's Cyclopedia. He was an ardent advocate of the metric system of weights and measures, and to the above cyclopedia, among other matter, contributed a most elaborate article on the weights and measures of all countries.

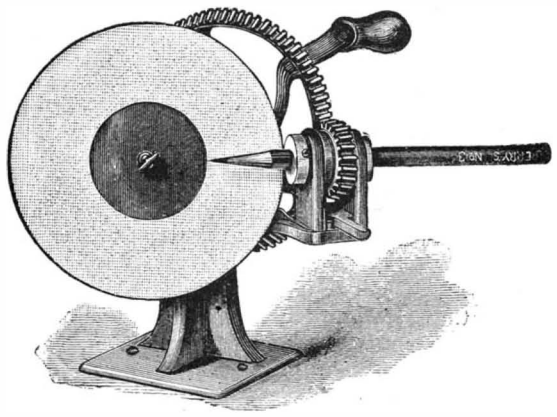
He was the recipient of honorary degrees from many universities, and his life work covered so extended a field that space will not permit even a full recapitulation of it here. In the great scientific development of Columbia College through the School of Mines the predominant bent of his mind found most congenial work. His funeral took place on May 2, and was attended by a numerous and representative assemblage.

© 1889 SCIENTIFIC AMERICAN, INC.

GEM PENCIL SHARPENER.

This sharpener must be made stationary with screws to the desk, table, or counter on which it is used.

It will sharpen any pencil, large or small, and will

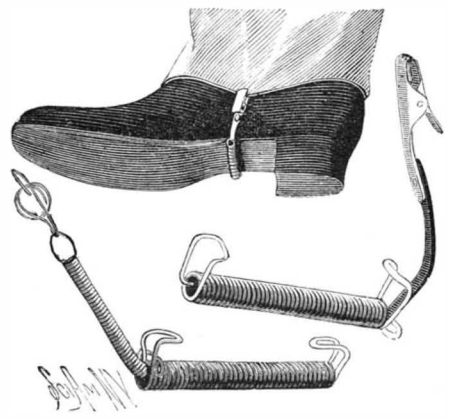


GEM PENCIL SHARPENER.

point a red or blue pencil perfectly, which all will appreciate who have tried to sharpen these pencils. To sharpen a pencil, push it through the chuck, press against the tail piece of the chuck holder, so as to bring the end of the pencil against the sand paper disk, and bring to a point by turning the crank. Any length of bevel on the end of a pencil desired can be obtained, and if a very fine point is desired, such as for artist's use, a piece of emery paper can be substituted for the sand paper, which answers for all ordinary purposes. This device is manufactured by Messrs. Gould & Cook, for Messrs. Goodnow & Wightman, of Boston, Mass.

AN IMPROVED TROUSERS STRAP.

The accompanying illustration represents a valuable device for the use of bicyclists and horseback riders,



CARTER'S IMPROVED TROUSERS STRAP.

to prevent the trousers from working up or from coming in contact with the wheel. It has been patented by Mr. George T. Carter, of Pittsburg, Pa. It is simple, durable, easily made and inexpensive, and both forms were thoroughly tested last summer by a large number of users, and pronounced a perfect success. The device clasps the sole just forward of the heel by two hooks connected by a spring, and is attached to the inside lower edge of the trousers leg by a light coil spring for bicycle riders, or by a band, elastic or not, as preferred for horseback riders. When in use the device is concealed from the view of passers-by, while it does not change the ordinary appearance of the trousers leg.

For further information relative to this invention address Mr. George T. Carter, Hamilton Building, Pittsburg, Pa., or Mr. Wendell M. Smith, Wilder Building, Rochester, N. Y.

Floating Industrial Exhibitions.

Floating exhibitions seem to be a success so far as Spain and Germany are concerned. A fine steamer loaded with the best specimens of all kinds of goods lately sailed from Spain for South America. The German Export Company has decided to apply the sum of $1,000,000 (5,000,000 marks) on the building, equipment, and working of a very large steamer which is to serve as a floating exhibition. The vessel in question will be called Kaiser Wilhelm, and the principal dimensions are as follows: Length, 564 ft.; breadth, 66 ft.; depth, 46 ft.; so the question is not of a small craft. The steamer is to have four engines, entirely independent of each other, and four propellers. She is to be fitted in exceptionally good style. The expenses for a two years' tour are calculated at $785,000, while the takings for hire of room and profits on sale are expected to reach $1,815,000, leaving the very handsome profit of more than $1,000,000. The steamer will, according to the present arrangements, be ready to start in the spring of next year. A previous undertaking of a similar nature, the steamer Gottorp, dispatched from Hamburg, is understood to have given a satisfactory result. Not only are Spanish and German goods being shown in many different parts of the world, but the staff accompanying steamer has ample opportunities for studying in each place the various local and special requirements, and to see to what extent and in what manner the different wants are being supplied, either by home or other foreign makers.

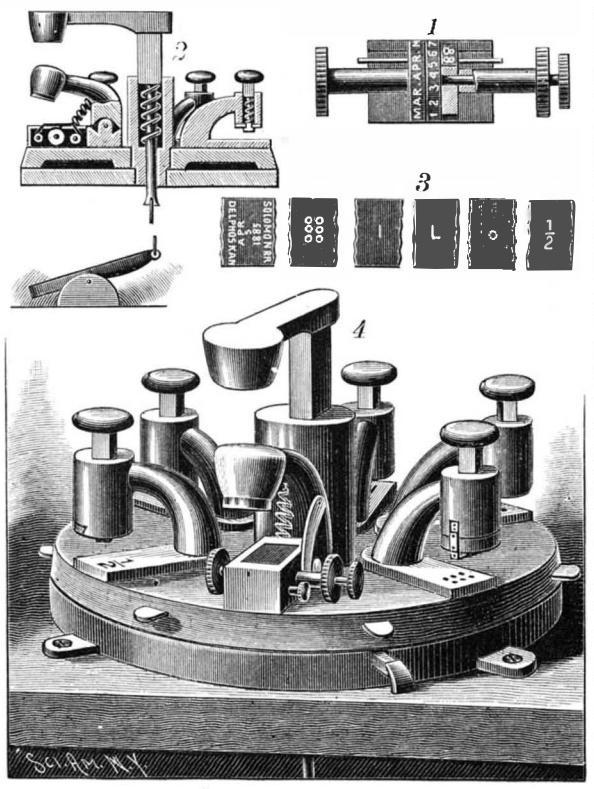
How many years longer must the American people wait and see the foreign trade carried off by other nations by simple devices such as the above and government subsidies? If laws were passed giving liberal payments to vessels of the highest speed for carrying the mails, we should soon have a greatly increased commerce.

Half a Century of Inventions.

Those of us not yet fifty years of age have probably lived in the most important and intellectually progressive period of human history. Within this half century the following inventions and discoveries have been among the number: Ocean steamships, street railways, telegraph lines, ocean cables, telephones, phonograph, photography and a score of new methods of picture making, aniline colors, kerosene oil, electric lights, steam fire engines, chemical fire extinguishers, anæsthetics and painless surgery; gun cotton, nitro-glycerine, dynamite, giant powder; aluminum, magnesium, and other new metals; electro-plating, spectrum analysis and spectroscope; audiphone, pneumatic tubes, electric motor, electric railway, electric bells, typewriter, cheap postal system, steam heating, steam and hydraulic elevators, vestibule cars, cantilever bridges. These are only a part. All positive knowledge of the physical constitution of planetary and stellar worlds has been attained within this period.—*Homiletic Review.*

A COUPON TICKET STAMP AND PUNCH.

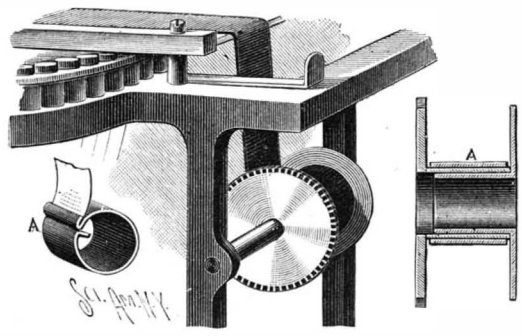
The accompanying illustration represents a stamp and punch designed mainly for the use of railroad ticket agents, for indicating on or in the ticket its date, the destination for which issued, and other particulars, the whole being mounted upon an adjustable revolving table controlled by a catch for bringing the stamp and punches under a hammer or striker common to them all, and operated by a foot treadle, leaving the hands free. It is a patented invention of Mr. Wilson M. Dunaway, of Hoxie, Sheridan County, Kansas. Fig. 1 represents a vertical transverse section through the ticket stamp, Fig. 2 a vertical section, Fig. 3 a face view of the tickets in part, and Fig. 4 a perspective view of the whole device. A revoluble table is mounted upon a stationary base, a ticket stamp and a series of punches, each having an independent bed piece, being detachably secured to the upper side of the revoluble table, the punches and stamp being arranged to allow of their being brought under a vertically reciprocating hammer or striker, this striker having an operating rod extending down through a central tubular bearing. A treadle is connected with the lower end of the rod to operate the striker, and a spring throws the rod upward after each stamp or punch has been made. An automatically operated inking ribbon is arranged in connection with the stamping arm, while the several punches, making different marks, are in ordinary but separate use for similar purposes. Thus, after the ticket is stamped, the first punch may be used to indicate the destination, the second the class of conveyance, the third whether the ticket is a limited one, the fourth the date, the fifth whether it is half or full fare, etc. Of course only such of the punches need be used as occasion requires, by simply turning the revoluble table to bring a particular punch under the hammer or striker.



DUNAWAY'S COUPON TICKET STAMP AND PUNCH.

IMPROVED INKING DEVICE FOR TYPE WRITERS.

The illustration herewith represents an inking ribbon spool for type writing machines, by means of which the ribbons can be quickly and easily adjusted, and ribbons of various colors can be readily interchanged with but a single set of ribbon spools fitted to the machine. This invention has been patented by Mr. Harvey Ray, of Mobile, Ala. One side of the spool has peripheral teeth to engage mechanism of the type writer as the machine is operated, and on this toothed side is fixed a hub, slotted to receive an inwardly bent tongue of the inking ribbon bobbin, as shown at A in the small figure and in the sectional view. This bobbin consists of a plate of metal bent around from

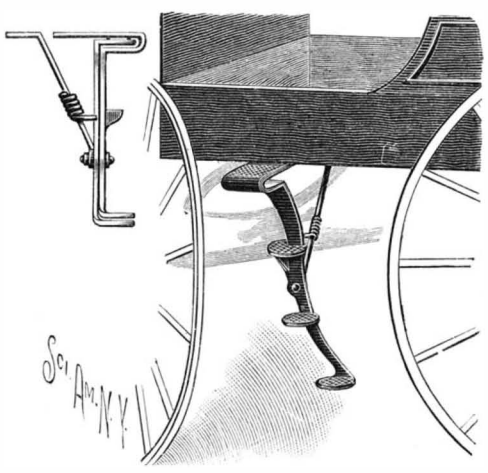


RAY'S INKING RIBBON SPOOL FOR TYPE WRITERS.

its tongue to fit loosely upon the fixed hub, and at the other end is bent upon itself to form a clamp into which the end of the inking ribbon is fastened. The other side part of the spool has a hub which fits snugly inside of the other fixed hub, and against the end of the bobbin, the side plates thus forming walls between which the inking ribbon is held truly edgewise. By removing the movable side portion, the bobbin with the ribbon wound on it may be readily slipped from the fixed hub, and replaced by another bobbin carrying a fresh ribbon, or one of a different color, without soiling the fingers.

AN IMPROVED FOLDING STEP FOR VEHICLES.

The accompanying illustration represents a folding carriage step having an upper section and lower section pivoted thereto, each section being provided with tread plates. This invention has been patented by Mrs. Mattie M. Marsh, of Moscow, Idaho Ter. The sections when folded one upon the other are parallel,



MARSH'S VEHICLE STEP.

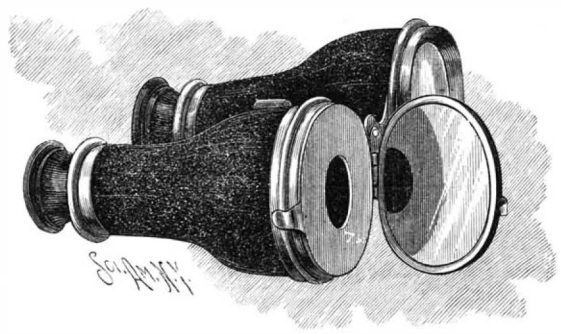
and are pivotally connected by a bolt or pin, as shown in the small view. The sections may be either straight or curved, as desired. The upper end of the main section is bent to form a tread plate, and so that it can be secured to the vehicle body, while at its lower end is another tread plate. The extremities of the pivotal or drop section are bent outward to provide upper and lower tread plates, this section being so made that it will fold with the upper one. The step is braced by a rod secured to the inner end of the pivot pin and the under surface of the vehicle body, a spring coiled around this rod serving to hold the lower section in folded position when it is not necessary to use it, but the tension of the spring being so light that the section can be readily disengaged and brought to the drop position.

THE *Timberman* does not seem alarmed at the prospect of an early destruction of our timber supply. It asserts that Puget Sound has 1,800 miles of shore line, and all along this line, miles and miles farther than the eye can reach, is one vast and almost unbroken forest of enormous trees. The forests are so vast that, although the sawmills have been ripping 500,000,000 feet of lumber out of them every year for the past ten years, the spaces made by these inroads seem no more than garden patches. An official estimate places the amount of standing timber in that area at 500,000,000,000 feet, or a thousand years' supply, even at the enormous rate the timber is now being felled and sawed. The editor adds that the timber belt of Washington Territory covers an area equal to that of the States of Vermont, Massachusetts, Connecticut, and New Hampshire.

© 1889 SCIENTIFIC AMERICAN, INC.

A MIRROR ATTACHMENT FOR OPERA GLASSES, ETC.

This device, readily applicable also to spy glasses or telescopes, consists in an adjustable reflector or mirror attachment, in front of the object lens, to provide means whereby the person using the glass can see objects at the side or in the rear without change of position. The invention has been patented by Mr. August Janzon, of 119 East Chicago Avenue, Chicago, Ill. The attachment consists of a circular metal or other plate, having a central contracted aperture fitting directly over the object lens, by means of a double jaw-like clamp or clip, and a hinged cover containing a mirror. This attachment is readily applied by springing the jaws, suitably shaped for that purpose, over or partly



JANZON'S MIRROR ATTACHMENT FOR OPERA GLASSES, ETC.

around the outer end portion of the tube containing the object lens, the mirror being then opened or adjusted to any desired angle. The opening in the plate resting against the object lens is made smaller than that lens to prevent disturbance of light rays emanating from the front. The device is readily detachable, and of a shape and size to be easily carried in a small pocket.

A MAGNET FOR EXPERIMENTATION.

BY GEO. M. HOPKINS.

The annexed engravings represent a large magnet which is well adapted for experimental work. With a current from six medium sized bichromate battery cells it is capable of sustaining about one thousand pounds. It is provided with a switch, so that it may readily be adapted to a light or a heavy current by combining the several coils in series or in parallel. It is made separable, to permit of using the coils detached from the core.

For the construction of the magnet 18 pounds of No. 14 double-covered magnet wire are required, also two well annealed cylindrical bars of soft iron, 8 inches long and 1½ in. in diameter for the core, a flat, soft iron bar 2½ inches wide, 8 inches long, and ¾ inch thick for the yoke, a bar of the same kind 7 inches long for the armature, two double wooden spools 4 inches in diameter and 7¾ inches long, with flanges 1 1/16 inch wide and 7/16 inch thick.

The walls of the spools are 1/16 inch thick. Each space in each spool is filled with the No. 14 magnet wire. There are two ways of winding the wire. According to one method a hole is drilled obliquely downward in the flange, and one end of the wire is passed from within

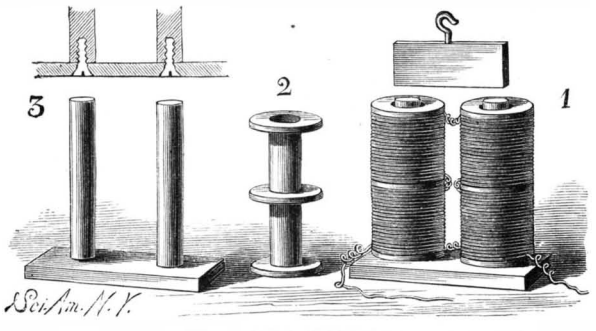


Fig. 1.—MAGNET FOR EXPERIMENTATION.

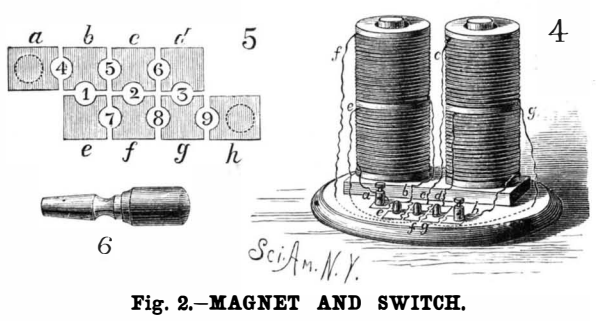


Fig. 2.—MAGNET AND SWITCH.

outward through the hole, and the spool is wound in the same manner as a spool of thread, the wires at the end of the coil being tied together with a stout thread to prevent unwinding. Each section of each spool is filled in the same manner.

Although this is the quickest way to wind the magnet, it is not the best way, as the inner end of the coil is liable to be broken off, when the entire coil must be rewound to secure a new connection with the inner end. The correct way to wind the wire is to take a sufficient length and wind it from opposite ends on two bobbins. Wind the wire once over the spool from one of the bobbins, then wind from the ends of the coil thus formed toward the middle, first with wire from one bobbin, then from the other bobbin, then wind from the middle back each way toward the ends in the same way, then again toward the center, and so on.

By this method both terminals of the coil are made to come out on the outer layer.

Fig. 1 of the illustration shows the completed magnet and its armature. Fig. 2 is a detail view of the spool. Fig. 3 shows the cores and yoke, both in perspective and section, the sectional view exhibiting the method of fastening the cores to the yoke by means of screws. Fig. 4 shows the magnet mounted on a wooden base provided with a plug switch for connecting the coils in parallel or in series. Fig. 5 is an enlarged view of the switch, and Fig. 6 shows one of the plugs by which the connections are made.

The switch is formed of brass blocks, *a*, *b*, *c*, *d*, *e*, *f* *g*, *h*, arranged in two series as shown in Fig. 5. The blocks, *a*, *h*, are provided with binding posts for receiving the battery wires. The blocks are provided with semicircular notches forming the plug holes, 1, 2, 3, 4, 5, 6, 7, 8, 9.

The block, *a*, is connected with the lower terminal of the lower left hand coil, and the block, *e*, is connected with the upper terminal of the same coil. The block, *b*, is connected with the lower terminal of the upper left hand coil, and the block, *f*, is connected with the upper terminal of the same coil. The block, *h*, is connected with the lower terminal of the lower right hand coil, and the block, *d*, is connected with the upper terminal of the same coil. The block, *g*, is connected with the lower terminal of the upper right hand coil, and the block, *c*, is connected with the upper terminal of the same coil. When the holes, 1, 2, and 3, are plugged, the current goes in series through all the coils. By plugging the holes, 4, 7, 2, 6, and 9, the current goes through the coils two in parallel and two in series, reducing the resistance to a quarter the original amount. By plugging the holes, 4, 5, 6 and 7, 8, 9, the current goes through all the coils in parallel, and the resistance is reduced to 1/16 the original amount.

The polar extremities of the magnet are drilled axially and tapped to receive screws by which are attached extension pieces for diamagnetic experiments.

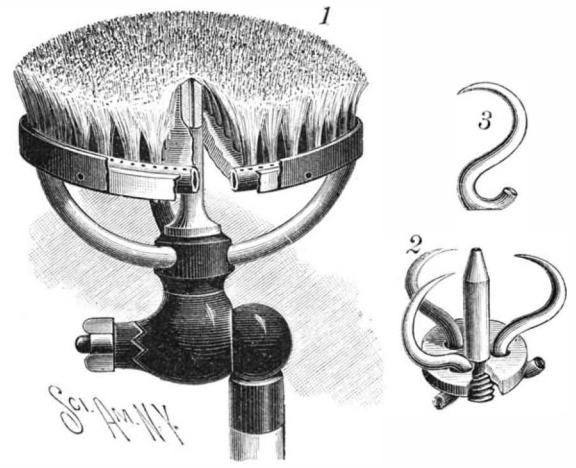
To retain the spools on the cores when the magnet is in an inverted position, a thin brass ring is screwed on the end of each core. The armature is provided with a hook for receiving a rope or chain, and the yoke has a threaded hole at the center for securing the eye for suspending the magnet.

AN IMPROVED CULTIVATOR.

The illustration herewith represents a roller cultivator specially adapted for use with listed corn or other plants growing in furrows, being designed to crush the clods in the furrows as well as upon the ridges, and leave the soil and trash in the same position as when left by the listing plow or any other furrow implement. The invention has been patented by Mr. Harrison Staggs, of Valencia, Kans. The frame is constructed with parallel spaced beams, extending longitudinally, and other shorter parallel beams outside of these, such beams carrying transversely-aligning standards, in which ridge rollers are centrally journaled, while an outer extensible furrow roller is journaled in the sliding standards. From the standards supporting the driver's seat two horizontal arms are rearwardly extended, between which a drum is journaled carrying a rope or chain attached by one end to a lever by the driver's seat, by means of which the drag plows, which may also be located at the front of the machine, may be elevated in turning corners. Downwardly and outwardly curved plates are adjustably secured to the inner faces of the plow beams, and to the lower end of these plates a vertical cultivator blade is pivoted which at one side is bent upon itself at the bottom, and carried inward in the form of a triangle, while above the triangular share is an essentially right-angled blade or scraper rigidly secured to the inner face of the cultivator blade. The furrow roller may be conveniently elevated as high as desirable, or the ridge roller may be entirely removed from the machine, which is designed to be used to cultivate listed corn when just appearing, or when five or six inches high, and is adapted to be adjusted to furrows of different width or depth.

A FOUNTAIN BRUSH AND SPONGE HOLDER.

The illustration herewith represents a device for holding a brush or sponge, and supplying the water for use therewith through the tubular handle, the device being especially adapted for use in cleaning windows and similar purposes. The wooden brush head is secured upon a central metal nozzle, a circular metal tube, with small apertures on its upper side, surrounding the brush head, and this tube being connected by side tubes to a thimble from which the central nozzle is extended. Surrounding the circular tube is a thin metal band holding in position an outer rubber band projecting beyond the edge of the holder, and designed to protect the object being washed from contact with the metal part of the head. When a sponge is to be used, the brush is removed with its central attached nozzle, and the sponge forced on the sponge holder nozzle, by connecting which with the central thimble the lower ends of the hooks are forced upward as shown in Fig. 2, forcing the upper points around the nozzle, and thus holding the sponge securely in position. Fig.



THOMPSON'S FOUNTAIN BRUSH AND SPONGE HOLDER.

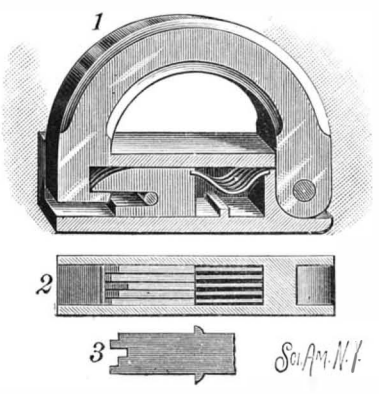
3 represents one of the sponge holder hooks. This invention has been patented by Mr. Samuel Thompson, of No. 47 River Street, Chicago, Ill.

Another Remarkable Gas Well.

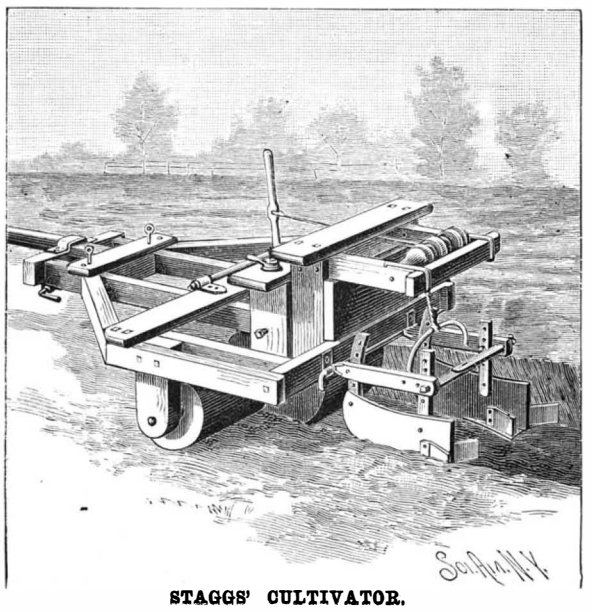
The largest natural gas well ever struck was bought in April 15, by the Philadelphia Company, near Belle Vernon, 26 miles from Pittsburg. It is running off 40,000,000 feet a day, the pressure being 800 pounds to the inch. It is one of the most significant wells ever struck, as it shows there are millions of new fields and that the supply is good for many years to come.

AN IMPROVED PADLOCK.

The padlock shown in the accompanying illustration forms the subject of a patent recently issued to Mr. Grant Brambel, of Detroit, Becker County, Minn. The bow or shackle is formed, at its outer end, with a recess, and an inclined bearing face upon a projection below the recess, the downward movement of the shackle being limited by a shoulder bearing against the upper plate of the case. Within the case are mounted any desired number of tumblers, formed with central slots and upper forward curved faces, partly shown in the sectional view, Fig. 1. The sections below the slots are of different lengths, as shown in Fig. 2. In the rear of each tumbler a spring is arranged, and there is also a stop to limit their rearward movement. In placing the tumblers in the case they are forced inward against the springs, after which a retaining pin is passed through apertures in the case and the slots in the tumblers, so that the springs will normally act to force the tumblers to the position shown in Fig. 1. The locking is effected by simply pushing the outer end of the bow or shackle into the case, when the tumblers are forced backward until the tongue on the lower end of the shackle has passed below the tumbler sections. The end of the key is stepped, as shown in Fig. 3, to coact with the tumblers employed in the construction of the lock.



BRAMBEL'S PADLOCK.



STAGGS' CULTIVATOR.

© 1889 SCIENTIFIC AMERICAN, INC.

THE GRAND SCENERY OF OREGON.

(*Continued from first page.*)

dered this district very rich in vegetation. The valleys of the many streams and rivers which abound in this section are most of them very fertile. The Rogue River, which has cut its way to the coast through a deep canon, is very beautiful and is very heavily timbered. A number of placer mines have been established along its shores, and much gold has been taken from the sand and gravels of its bed.

Our illustration gives a general view of Portland, which is the principal city of Oregon. It is located on the Willamette about 12 miles above its junction with the Columbia River. Its population in 1880 was 17,577, but it has grown rapidly under the impulse given it by the Northern Pacific Railroad. From its streets may be seen the beautiful cone-shaped glitter of Mt. Hood, which is the wonder and admiration of all travelers, and which rises from the vast plain to a height of 11,225 feet, solitary in its grandeur and standing like a sentinel watching over the destinies of the city. Its summit extends into the region of perpetual snow, and some idea of its beauty may be had from the photographs which we here reproduce.

Oklahoma the New Eden.

That innate and inbred desire of the members of the human family to get something for nothing—or next to nothing—must account for the mad race for quarter sections of land in Oklahoma, of which so much has been printed lately in our daily newspapers.

All the neighboring States of the Southwest, bordering on the newly opened territory, share in the excitement, and even the older States, like conservative Tennessee, are sending their contingents. Yes! Even the lake regions of the North are sending settlers. Among the excited throng are farmers, lumbermen, miners, mechanics, printers, store keepers, gamblers, saloon keepers, whisky men, and adventurers of every sort.

Already cities have actually been plotted on paper, and for one of them a bank has been organized which began business at noon on the now celebrated 22d day of April, 1889. The *Southern Lumberman* thinks that for some time to come it is altogether probable that *faro* banks in fair Oklahoma will considerably outnumber the legitimate financial institutions.

At the present time only one railroad runs through the new country, but several others go very near its boundaries, and these convenient thoroughfares are all putting on extra rolling stock on account of the unprecedented demand for transportation.

The General Land Office has established two offices —the one at Kingfisher Station and the other at Guthrie; while the Post Office department is straining every nerve in maintaining an effective postal service. There are said to be no fewer than seventy thousand applicants for the eleven thousand quarter sections of land that are available for settlement, so it is very evident that many pilgrims will be disappointed. There is no evidence to hand that Oklahoma lands are one whit better or richer in any respect than those in the Indian Territory, Kansas, Missouri, Illinois, or Tennessee, and yet hundreds of farmers are leaving comfortable homesteads in old settled communities and are gladly taking all the chances of pioneer life. Were there any indications of auriferous deposits of rich silver ore; of lead mines; of inexhaustible coal measures; of vast forests of hard woods; or in fact of any evidence of mineral or vegetable wealth out of the ordinary run, one could understand this mad rush; such not being the case, all our readers can do is to patiently await developments and then judge of the real value of Oklahoma and its lands. Land agents and law firms are circulating maps of the new Eden, and on paper it certainly looks to be a beautiful country; and *The Lumberman* thinks if the garden of Eden had been as well shown up by land lawyers and agents of old, the descendants of Adam would have mobbed that lonely angel with a flaming sword who guarded its gate and kept them out. Oklahoma is evidently a more desirable country, as it has required several hundred of Uncle Sam's blue coated angels, armed with repeating rifles, to keep the people out of it. Still, we are not going there—this year the editor adds —and we are not advising any of our friends to go to stay. It may prove a good field for the tourist who represents a good lumber firm, a burial case factory, or a tombstone quarry.

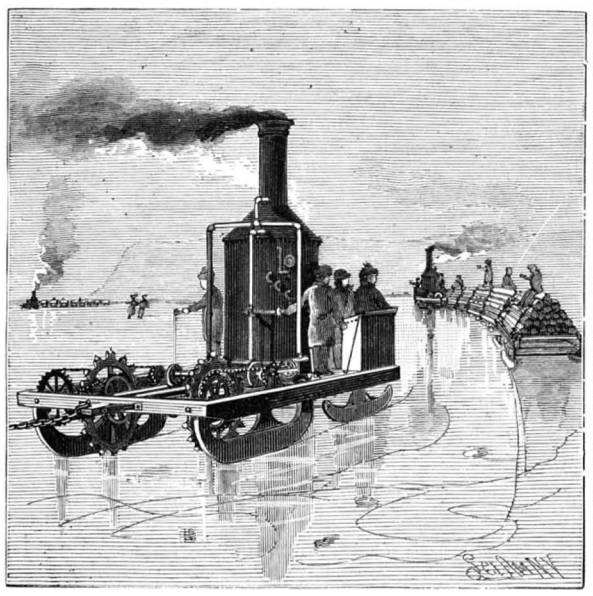
Rock Cuttings in the Proposed Nicaragua Canal.

The most serious feature of the Nicaragua canal project, in a contracting and financial sense, is the great rock cut at the eastern divide, 3 miles long and averaging 120 ft. deep by 80 ft. wide on the bottom, containing in all some 7,000,000 cubic yd. of material, or say 440 cubic yd. per lineal foot. There is no precedent, says *Engineering News*, for such an enormous cut, and it has been assumed that four years, at least, would be necessary to complete it, while many question the possibility of doing it in that time. The great rock cut at the Tilly Foster mine, Brewster's Station, N. Y., if it may be relied on as a precedent, would go far to relieve these doubts. From that cut 215,000 cubic yd. have been removed in 20 months within a lineal distance of 450 ft., or nearly 500 cubic yd. per lineal foot, and this by day work only, with a force of 150 men, or one man per yard of center line, by four cable hoisting plants only, or say one per 100 ft., and practically at the rate of about 4,000 cubic yd. per month per cable when working full time and with full force. Equal efficiency cannot be expected in tropical Nicaragua and temperate New York; but neglecting for the moment this very serious difference, a work conducted with equal efficiency, and with a cable hoisting plant for every 100 ft. of center line, would at the rate of 4,000 cubic yd. per month extract the necessary cube of 44,000 cubic yd. *in just* 11 *months* of solid work, and this without night work; while the force to accomplish this end, if the New York example were admissible as a precedent, would be about 5,300 men with 160 cable hoisting plants, or about 33 men per plant and per 100 ft.

This is not so large a number as to seem difficult of attainment, or to cause the men to be in each others' way, even if increased by a considerable percentage to allow for tropical inefficiency; and we fully believe that there are men in this country who can and will undertake to parallel this record if afforded the opportunity, and if the contracting wheat be winnowed from the chaff by some other and safer method than "lowest bid" and "influoence," so that those men who really understand from experience how to handle such work may have a fair chance.

A STEAM-PROPELLED SLED.

An invention by means of which a sled is designed to be propelled by steam power, and adapted to pull a



CONNIFF'S STEAM SLED.

train of sleds, has been patented by Mr. James F. Conniff, of Oconto, Wis., and is illustrated herewith. The main frame of the power sled is mounted on sets of runners, of which the rear set is pivotally connected to the under side of the frame. On the frame is a boiler supplying steam to an engine connected with driving shafts on either side, each of the shafts carrying a sprocket wheel communicating motion by a sprocket chain to a shaft mounted transversely at the rear end of the main frame.

From this shaft power is communicated to two propeller wheels, mounted in bearings in a frame that is free to swing up and down, whereby the wheels will be always in contact with the ice or snow. The periphery of each propeller wheel has projections with sharp cutting edges, to enable the wheel to take a firm hold on the ice or snow, whereby the power sled will be capable of drawing a train of sleds connected therewith.

A Recent Cat-astrophe.

An interesting exhibition of trained cats has been conducted for some time past by Leoni Clark, known on the variety stage as the "cat king." His troop of thirty cats has been a great attraction. Philadelphia has, of late, been the scene of many performances, and on the 24th ult. Mr. Clark thought that his troop of cats needed some medicine, and he went to a neighboring drug store and had a prescription, which was tried with good results many times, put up. He then assembled his troop of educated cats in a row and began to administer the medicine. After he had gone down the line giving dose after dose as far as the thirteenth cat, cat number one, with an unearthly shriek, leaped into the air and fell dead.

Cat number two followed suit. Cat number three did the same, and so it went on until thirteen cats that had taken the medicine lay dead before him. Mr. Clark is in a terrible state of mind over his loss, and will sue the druggist, who he claims put up the wrong prescription. The druggist declares that he put up exactly what Mr. Clark's prescription called for.

Correspondence.

A Suggestion for Introducing Wires in Electric Subways.

To the Editor of the Scientific American:

In the recent article on "The Electric Subways of New York City," I was struck with the extremely slow method of introducing the small line into the duct, preparatory to drawing the cable. It occurs to me the first line might be run through much quicker by air than with the jointed rod.

I should think a specially made large sized hand bellows would be sufficient to drive through a pasteboard cone with a light line attached. The line should be taken from a light, free-running reel.

Thimbles of different sizes could be made for the different sized ducts, so the nozzle of the bellows would fit any of them. One side of the thimble may be crimped sufficient to allow the line to enter the duct.

M. A. CURRIER.

Omaha, Neb.

Semi-solid Lubricants.

To the Editor of the Scientific American:

I note in your issue of April 27 that the well known mechanical engineer Joshua Rose speaks, in his Paris letter, of the use of a semi-solid lubricant on grinders forced by screw pressure upon the journals, and in speaking of it as a new idea "of much interest" he add: "I was informed that it was proposed to try a similar device upon the axle boxes of a locomotive. I should think it likely that such an axle box would, however, require a more continuous supply of lubricant than this would give." Concerning this it might be of interest to note that the idea is not new in this country, as at least over a year ago the Chicago and Northwestern Railway were using a solid lubricant, coming in the form of candles, upon their engines.

Just how successful it was I am unable to say. It was a white substance of about the size and hardness of an ordinary candle and some three or four inches in length, used in much the same manner described in his letter.

J. M. FARNSWORTH.

Vinton, Iowa, April 29, 1889.

Natural Gas in Kentucky and Indiana.

State Geologist Gorby, of Indiana, in relation to the natural gas development in Harrison County, Ind., and Meade County, Ky., says:

So far as it has been tested, the field stretches along the Ohio River about thirty miles, beginning at a point about twenty miles below Louisville and extending below Brandenburg. It has a width of seven or eight miles in each State, and contains about fifty wells, ten or fifteen of them on the Indiana side and the remainder of them in Kentucky. It is from the Kentucky wells that it is proposed to supply the city of Louisville. It will require a pipe line about thirty miles in length, and when I was there last, work upon it was being pushed vigorously. There were originally three companies that started out to supply the city, but they are merged into one organization now.

The Harrison County wells are shallower than those in Hamilton and Howard Counties, the gas being reached at a depth of 358′ in the river bottom. The bluffs along the river are about 200′ high, and the wells back from the stream require more boring, so that those sunk in different parts of the field range from 358′ to 550′ in depth. The Hamilton and Howard County wells, as I have observed them, run from 800′ to 1,000′. In some of those in Harrison County the supply is as abundant as in the average producing wells of Hamilton and Howard. Some of them are producing 4,000,000′ daily, and the output throughout the field is estimated at 50,000,000′ every twenty-four hours. The gas comes through a black shale, and is of about the same quality as that produced in other Indiana fields. There is more annoyance from salt water than there is in the Noblesville and Kokomo section, but this is obviated by the use of separators, which have been improved upon until some of them now work very satisfactorily.

I think there is a plentiful supply for Louisville, however, from the Kentucky portion of the field. It is astonishing what one moderately productive well will do when the gas is properly handled. In the State of Indiana the town of Portland, which has 2,000 inhabitants and several manufactories, is supplied by one well, with a capacity of 875,000′ daily, and one mill there with an engine of 20,000′ each day. Of course, where it is burned as an ornament or for advertisement in large flambeaus on the streets and in public places it is different. I am only speaking of cases where the gas is not wasted.

Preservation of Milk by Freezing.

It is said fresh milk may be preserved indefinitely by freezing it and maintaining it in the frozen state until wanted for use. Many of the steamers now sailing on distant voyages are provided with steam refrigerators, in which milk and other foods may readily be preserved for any length of time.

© 1889 SCIENTIFIC AMERICAN, INC.

Explosion of a Lime Light Gas Cylinder.

A serious explosion of a gas cylinder, on the 28th of January, in Dublin, Ireland, occurred, by which one person was instantly killed. It appears to be the practice abroad of compressing the oxygen and hydrogen gases up to a pressure of 750 pounds to the square inch, while in the United States the usual working pressure is 250 pounds. The particular reason for the explosion was explained by experts to be the careless mixing of the oxygen and hydrogen gases in one cylinder, which, in escaping in a room in which there was a gas light, ignited and caused the explosion. A peculiar feature of the case is that the man who was killed was one of the proprietors of the works where the gas is compressed. Their rule was to store the oxygen gas in black cylinders and hydrogen in red. The proprietor had an urgent application for oxygen gas, and being short of oxygen cylinders, took a red hydrogen gas cylinder, which he supposed was nearly empty (no evidence was shown that it was tested by a gauge to see what pressure of hydrogen it had), and charged it with oxygen gas.

The party intending to use it was notified that it was oxygen gas instead of hydrogen, but did not use it. It was afterward returned to the gas works, and the proprietor, forgetting that it contained oxygen, sent it out a second time to fill another order for a cylinder of oxygen and hydrogen. When the operator of the lime light made his connections and undertook to light the hydrogen gas at the end of the lime light jet, he was startled by a small explosion there. The cold metal of the burner, it is supposed, prevented the flame from extending back to the cylinder, and thereby prevented a more serious explosion. He at once disconnected the cylinder, labeled it "mixed gases," and returned it to the works. He also notified the proprietor of the dangerous character of the gases. But he seemed to look upon it lightly, since he told his foreman that the quantity of hydrogen was so small that there was no danger, and that he would use it himself. The cylinder was placed by itself in a room used for making mechanical drawings, in which was one gas light. But the testimony as to whether it was lighted or not is not clear; some of the employes and assistants maintained that it was. He went into the room alone and experimented with small quantities of the gas, opening the valve at the top in the usual way. Suddenly his brother, in an adjoining room, heard a slight report and crash of glass. He rushed into the room and found the proprietor lying on his back on the floor dead.

It would seem that he died from his own carelessness, as he had been advised to let the gas escape in open air.

In the United States it has become the custom to compress the oxygen gas in red cylinders and hydrogen in black. An extensive user of these gases in England states that one company doing a large business in supplying these gases there does not always adhere to the rule adopted there of putting oxygen into black and hydrogen into red cylinders, for he has had sometimes as many as a dozen black cylinders containing hydrogen delivered for one of red. To avoid errors at the works, it is suggested that the spindles and coupling screws be made larger for the oxygen cylinder than the hydrogen, and that both the cylinders be painted in totally opposite colors.

When one of these cylinders bursts from defective construction and overpressure, it is generally in the form of a narrow seam, and no damage is done unless the person happens to be near the rupture; then the force of the escaping gas, acting like a gun, will send objects before it to great distances, precisely on the principle of the dynamite air gun.

A peculiar accident of this nature came to our attention, and is related as follows: Two cylinders of oxygen and hydrogen, placed on their long sides on the floor of a wagon, were being transported over a paved road. A boy was sitting on one of the cylinders. When they had nearly reached their destination, a peculiar report was heard and the driver noticed, on looking around, that the boy had disappeared. He was found unconscious, lying in the street, about fifty feet from the wagon. At first he was thought to be dead, but he subsequently recovered and escaped without a scratch. The mystery was never explained, except that the boy says he felt a tremendous breeze of wind pass upward in front of him and was instantly unconscious. One explanation given is that as he happened to be over the rupture in the cylinder, the escaping gas issuing with a tremendous velocity, at a pressure of 250 lb. to the square inch, lifted him into the air something on the principle of a rocket. On passing near his mouth it may have taken his breath away and made him unconscious. We are indebted to the account published in the *Br. Jour. of Photo.* for the facts regarding the Dublin explosion. It is perfectly safe to use gas in cylinders tested to three times the actual pressure usually employed, and it is very rare that the bursting of one is reported. A most useful adjunct is a gauge attached to the cylinder by a T joint between the cylinder and the lime jet, since it apprises the operator of the pressure he has on hand of either gas. Generally a trifle more of hydrogen is used than of oxygen. There are also pressure regulators made that can be attached to the cylinder for equalizing the pressure.

Natural History Notes.

Relation of Ants to the Seeds of Plants.—It is well known, says Prof. Trelease, in an address before the Cambridge Entomological Club, that in warm countries some ants carefully and systematically harvest the fruit of species of plants which are to their taste, and it would seem that they take some agricultural interest in the welfare of these plants. While this indicates a high grade of care for the food-producing species, the benefit to the plant is that which a cultivated crop receives from the self-interest of man in its preservation and propagation, without in any way approaching symbiosis.

The resemblance of some seeds or fruits to different kinds of insects or other arthropods has several times been commented on. Perhaps it is still an open question whether or not this is mimicry, but it has been so regarded by a number of naturalists, being held in some cases to secure dissemination by insectivorous birds, etc., and in others to render the detection of the seed by graminivorous birds difficult. Suggestions are not wanting that in some of these resemblances, and some other seminal peculiarities, adaptations exist for securing dissemination through the agency of ants. Mr. Charles Robertson states that the arils of *Sanguinaria* seeds possess an attraction for ants, which drag the seeds off for considerable distances. According to Lundstrom, *Melampyrum* seeds resemble ant pupæ in size and form, and, he believes, in odor also, to such an extent that ants are deceived into caring for them as if they were their own pupæ, until the mistake is discovered. Mimicry, such as he suggests, is a very difficult thing to prove to the satisfaction of unbiased biologists, but observations cited by him would seem to show that unusual attention is really paid to these seeds by ants which do not subsequently make use of them for food. The bracts of some species of this genus bear extranuptial nectar glands, which Rathay, who studied them carefully, could not explain by the protective theories of Delpino and Belt, or Kerner, though they are visited by ants. As the latter are thus attracted close to the fruit, Lundstrom suggests that the office of these nectar glands may stand in close relation with the supposed mimicry observed in the seeds; but this entire subject, while full of suggestion, is still in need of careful and comparative study.

Flowers altered by Mites.—Some experiments made by Prof. Plyritsch, at Innspruck, and recorded in the *Transactions* of the Imperial Academy of Vienna, show that double flowers may be produced by the agency of mites. He transferred some mites found on a wild double flower of *Valeriana tripteris* to other plants of the natural order Valerianaceæ, Cruciferæ, Scrophulariaceæ, Commelynaceæ, etc., with the result that various kinds of double flowers were obtained, as well as torsions and fasciations of the shoots. The doubling consisted in petalody of the stamens and pistils and prolification and duplication of the corolla. Even the leaves were affected by the mites, the margin showing comb-like teeth. In *Linaria cymbalaria* peloriate flowers and other changes were found. The results obtained would appear to depend upon how far the subject of the experiment is a good host plant for the mites, the plant in such case being quite crippled. In several cruciferous plants in which the flowers are normally ebracteate, bracts were developed by introducing the mite found on the hazel to the plants. In the daisy the disk florets became green, the leaves more hairy, and the involucral bracts elongated. It was also observed that after infection lateral bud development was accelerated, while growth in length was slow.

Preservation of the Colors of Flowers.—A writer in the *Revue de Botanique* states that he has succeeded in preserving the form, beauty, and freshness of flowers by dipping them in a varnish composed of 20 parts of powdered copal dissolved in 500 parts of ether, sand or powdered glass being used to make the resin dissolve more readily. The flowers are dipped in the liquor, carefully withdrawn, and allowed to dry for about ten minutes. This is repeated four or five times in succession. A second process given is to immerse the stem of the fresh plant in a solution of 31 grammes of alum, 4 of niter, and 186 of water, for two or three days, so that the liquid may be absorbed. The plants are then pressed in the ordinary way, except that dry sand is sifted over the flowers and the packets submitted to a gentle heat for about twenty-four hours. A third process consists in plunging the plant for an instant in a boiling solution of 1 part of salicylic acid in 600 of alcohol (too long an immersion will decolorize violet flowers), and then drying between bibulous paper. For restoring the color to red flowers which have turned violet or blue in drying, a piece of paper moistened with dilute nitric acid (1 part of acid to 10 or 12 parts of water) is placed under the plant, and then the whole submitted to moderate pressure for a few seconds between blotting paper. The amount of pressure and the strength of acid required will vary in different cases, but the green leaves should never be subjected to the acid, or they may lose their color.

Preservation of Animal Colors.—As alcohol has a tendency to alter or even wholly destroy the colors of animal specimens preserved in it, Mr. Fabre Domergue has been led to make some researches with a view to finding a substitute for it that does not possess this inconvenience. He recommends the following mixture:

Sirup of glucose, diluted	1,000 parts
Glycerine	100 "
Methylic alcohol	200 "
Camphor, to saturation.	

The glucose is dissolved in warm water, and, after it is cool, the glycerine, alcohol, and a few pinches of camphor are added. As this mixture is always acid, it should be neutralized by the addition of a small quantity of a solution of potash or soda. After filtering through paper, a few fragments of camphor are allowed to float upon the liquid.

This liquid is well adapted for the preservation of hard-shelled crustacea, of green, blue, or red color, and also of certain echinoderms. Most soft animals preserve their color in it, although they contract considerably.

Protective Secretions in Plants.—From some investigations made by Prof. Stahl on the use of secretions to plants, the conclusion is reached that these secretions in many plants serve to protect the latter against animals. Thus, tannin was found to be objectionable to slugs, slices of carrot dipped in its solution remaining untouched by them. On the other hand, plants containing acid oxalates of potash, such as sorrel, rhubarb, and begonias, were eaten with avidity by slugs when this salt was removed, although previously they would not touch the plants, nor would they attack carrot soaked in a solution of the salt. In the case of hellebore the vegetable poison present appears to act as a protective agent. M. Stahl also points out that the incrustations of carbonate of lime on saxifrages and the silicious coating on grasses and equisetums, and the raphides in plants, have a similar protective duty, since if these be removed, the leaves, etc., are speedily attacked by slugs. He found also that essential oils, such as those of rue, herb Robert and *Acorus calamus*, are also repulsive to slugs. This idea seems to receive confirmation from the well-known fact that cattle will not touch the common buttercup in its fresh state, although they eat it readily when dried, and that colchicum is always left untouched by them. Nevertheless the peppermint, and occasionally even the aconite (*A. Napellus*), is eaten in London gardens by the common cabbage moth (*Mamestra brassicæ*).

Epiphytic Plants of the Tropics.—Dr. A. F. W. Schimper has published a second installment of his magnificent work on this subject, this portion relating to the flowering plants and vascular cryptogams. The order by far the most largely represented is Orchideæ, of which 119 species are enumerated in tropical America alone. Next come Filices (American only) and Bromeliaceæ 18 each, Gesneraceæ 16, Rubriaceæ 14, Ericaceæ 13, and Melastomaceæ 10. The largest number of epiphytic plants are found on the arbored vegetation of mountain slopes in tropical and subtropical countries. Some species, but only those found on the lower branches of trees, grow also on rocks. The author describes the different ways in which the seeds of epiphytes are adapted from their peculiar habit. The most common contrivance is that they are provided with a succulent envelope which is devoured by animals, and the seeds themselves then voided on to the branches of trees; or they are so small as to be carried readily by the wind to fissures in the bark, as in the Orchideæ; or they are provided with a floating apparatus. Excluding true parasites, their nutrition is obtained in several ways. They may find their nutriment on the moist surface of the host, and are then usually protected against desiccation by the presence of receptacles for holding water. Others have aerial roots for absorbing moisture, like the orchids, or roots which reach the surface of the soil; while others again form for themselves a matrix of decaying animal and vegetable matter.

Effect of Minerals on Plant Growth.—From some recent experiments by Mr. Henri Jumelle in cultivating lupines in distilled water and in a mineral solution, it appears that the presence of mineral substances in the plant is accompanied with a greater production of parenchyma and a formation to a less degree of sustaining elements. Moreover, if the plants submitted to the experiment be dried, it is observed that, in a general way, the stalk and leaves of the plant provided with salts contain a larger proportion of water at this period than do these same organs in plants deprived of salts.

Upon the whole, the absence of salts notably modifies the structure of a plant, but the modifications seem to be due, in great part, less to the absence of salts than to the diminution of the constituent water that results therefrom.

A RACE between electrical launches lately took place in London. Five boats took part in the contest.

© 1889 SCIENTIFIC AMERICAN, INC.

TRIPLE EXPANSION ENGINE.

We illustrate a novel construction of a triple expansion engine constructed by Cole, Marchant & Co., of Bradford, to the designs of Rhodes & Critchley, of Bradford, and given in a recent number of *Engineering*. The three cylinders are placed one above the other, and all the piston rods are connected to one and the same crosshead. This arrangement was adopted on account of the limited space at the disposal of the designers, the engine house being only 30 feet in length by 8 ft. 9 in. in width. The cylinders are 8¼ in., 13¼ in., and 21 in. in diameter respectively, with a stroke of 4 ft. The crosshead has been made very strong, of cast steel, and has slide blocks 2½ in. in thickness, and of a length equal to the distance from the center of the high pressure piston to the center of the low pressure piston.

The valves of the high pressure cylinder are of the Corliss type, the steam boxes being 10 in. long by 4½ in. in diameter, and the exhaust boxes 5 in. in diameter. The valves are made to draw out through the back bonnets. The disks on which are mounted the tripping arrangements are made of wrought iron forged plates. The pawl is of steel, and is fitted with a steel pin 1 in. in diameter; on the same axis is also fitted the cam and lever for tripping the pawl, which is of steel casehardened. The wrist plates are of cast iron bushed with steel liners and fitted with 1⅜ in. steel casehardened pins. The details of construction of this trip gear, which is the designers' special pattern, are clearly shown by the engravings.

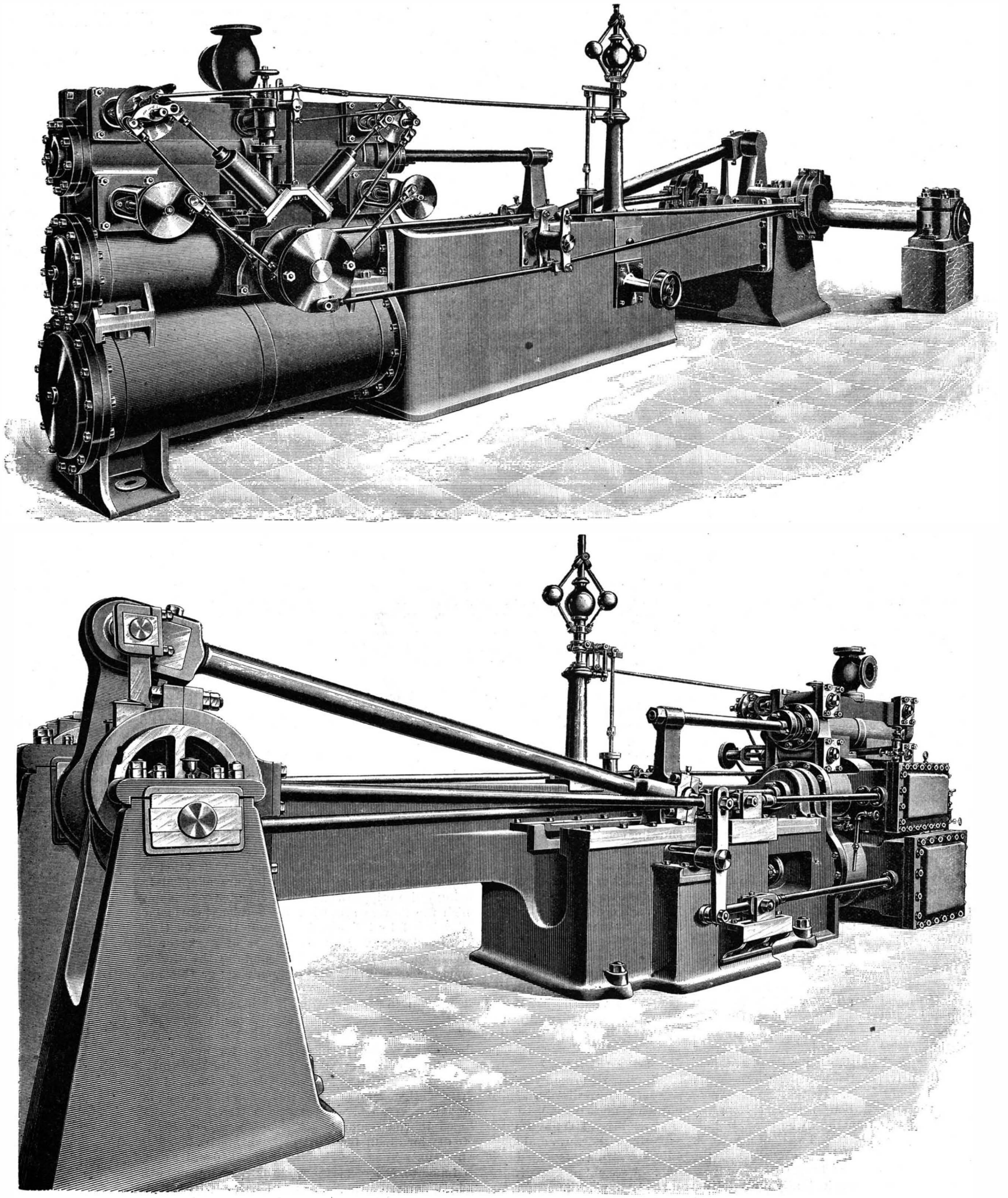
The intermediate cylinder is fitted with two slides and cut-off plates, worked directly by eccentrics 2½ in. wide on the drag shaft. These valves can be regulated to cut off earlier or later as required to equalize the amount of work done by the respective cylinders. In order to facilitate the adjustment of the valves the cut-off spindle has a screw index and wheel.

The low pressure cylinder is fitted with an ordinary slide valve worked also by an eccentric on the drag shaft. The pistons are all on Buckley's principle. The steel piston rods are 3 in. in diameter for the high pressure cylinder, 3¼ in. for the intermediate pressure cylinder, and 3½ in. for the low pressure cylinder.

The crosshead is fitted with a steel gudgeon 5½ in. in diameter in the body and 4¾ in. in diameter in the necks, with outer necks 2½ in. in diameter by 2½ in. long, for the air pump links. The connecting rod is 10 ft. long, 4½ in. in diameter at the crosshead end, 4¾ in. in diameter at butt end, and 5½ in. in diameter in the center, forked at the crosshead end and solid at the butt end. The fork end is fitted with a wrought iron cap and four 1¼ in. bolts and lock nuts. The butt end is fitted with a steel block, die, and brasses, with 1¼ in. steel adjustment screw.

The crank is 6 in. broad, turned and polished all over, and fitted with a steel pin 4¾ in. in diameter by 6 in. long, with an outer neck for the drag crank. The crankshaft is 9 in. in diameter in the body and 8½ in. in diameter by 14 in. long in the bearing for the crank pedestal, and 10 in. in diameter for flywheel.

The eccentric rod which drives the low pressure



IMPROVED TRIPLE EXPANSION ENGINES, WITH CORLISS VALVE GEAR.

© 1889 SCIENTIFIC AMERICAN, INC.

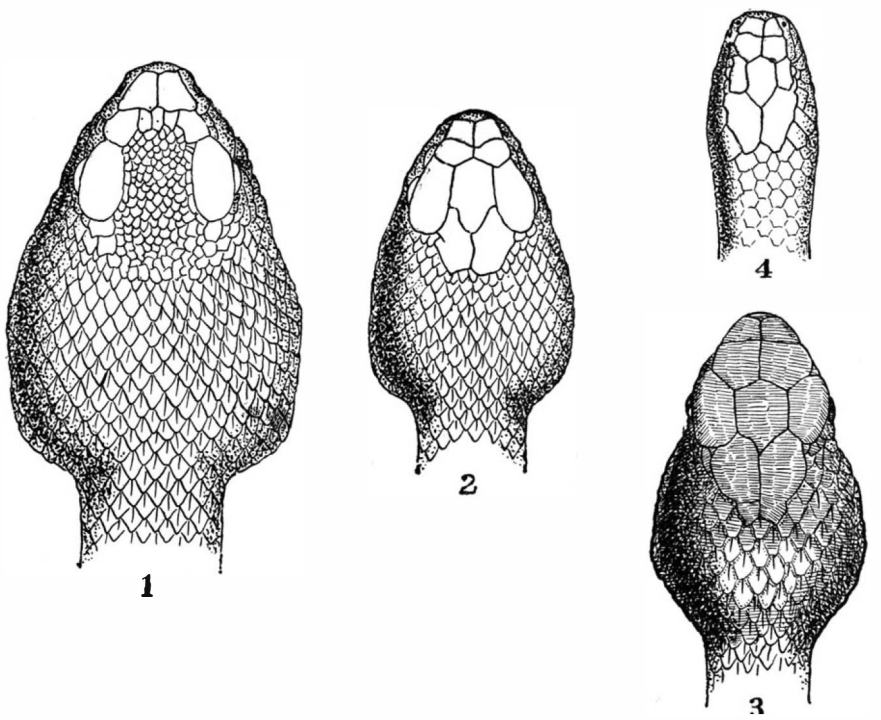
valve is coupled to a lever mounted on a rocking shaft fixed in adjustable phosphor bronze bearings. The eccentric rods for driving the Corliss wrist plates are hung on two two-armed rocking levers mounted on a 4 in. cast iron stud pin, which is bolted to the bed plate.

The air pump already in the engine house was used again. A cast iron liner was put in, 15½ in. in diameter. This pump is not shown in the engravings, but is of the vertical type, and is worked from links connected to the crosshead. The stroke is 18 in.

THE VENOMOUS SERPENTS OR TOXICOPHIDIA OF THE UNITED STATES.

The rattlesnakes, family *Crotalidæ:* In genus *Crotalus*, the true rattlesnakes, the head above is covered with small scales. (See Fig. 1.) The species are: 1. Eastern or mountain rattlesnake, *Crotalus horridus.* It is found from Maine to Arkansas and Texas. It varies greatly in color, being found dark brown, nearly black, to pale sulphur yellow with ashy gray bands. 2. The diamond or Southern swamp rattlesnake, *Crotalus adamanteus.* It inhabits North Carolina to Florida. There are several varieties of this repulsive serpent, which from time to time have been described as new species; variety *atrox* is found from Texas to California; variety *scutulatus* in Arizona. 3. Western rattlesnake, *Crotalus confluentus*, habitat Nebraska to Oregon, south to Texas and New Mexico. The red rattlesnake, *C. pyrrhus*, of Arizona, seems to be a local variety. 4. The bull-dog rattlesnake, *Crotalus molossus,* of which the U. S. Museum, at Washington, contains only three specimens, one each from Arizona, Texas, and Mexico, is nearly related to the harsh rattlesnake, *C. durissus*, of Mexico and South America, and may be a variety of the latter. 5. The horned rattlesnake, *Crotalus cerastes*, found from Colorado to California and south to Mexico. 6. The tiger rattlesnake, *Crotalus tigris,* found in New Mexico and Arizona. The St. Lucas rattlesnake, *C. enyo*, bears a close relationship to *molossus* and *durissus*, and it is doubtful if it may be called a distinct species. Four specimens from Lower California are in the United States Museum. 7. The lucifer rattlesnake, *Crotalus lucifer*, bears a near resemblance to the diamond rattlesnake variety *atrox.* It is possible that the Oregon rattlesnake, *C. Oregonus*, described by Dr. Holbrook, is the young of this species. His faded type specimen in the collection of Academy of Natural Sciences, Philadelphia, measures about a foot in length, and the tail has but one button, which proves it to be quite immature. *C. lucifer* has been found in Oregon, California, and Arizona. Mitchell's rattlesnake, *C. Mitchellii*, is founded on one individual from Lower California. It is a doubtful species, resembling *lucifer* and *atrox.* 8. Kennicott's asp or rattlesnake, *Aploaspis lepida*, from the Rio Grande, Texas, has been described from two alcoholic specimens of heads only, and requires further study.

The second group of rattlesnakes belongs to the genus *Crotalophorus* of Gray, 1825. Linnæus in 1735 first gave the name *Caudisona* to all the known rattlesnakes; but subsequently rejected it, and in 1749 adopted *Crotalophorus.* In 1754, and subsequently, he placed all the rattlesnakes in the genus *Crotalus.* Laurenti in 1768 adopted the genus *Caudisona* for the rattlesnakes. Gray in 1825 placed the rattlers with large plates on the head in the genus *Crotalophorus;* one year later, 1826, Fitzinger proposed *Caudisona* for the same group; therefore, Gray's genus *Crotalophorus* (a rattle bearer) should be retained. This family of rattlesnakes have the upper surface of the head covered with nine large plates, as seen in many non-venomous serpents. (See Fig. 2.) 9. Massasauga or prairie rattlesnake, *Crotalophorus tergeminus.* In 1854, Prof. Baird collected several specimens in a white cedar swamp at Byron, Genesee Co., N. Y. "Nessmuk," in *Forest and Stream*, says he observed it in a tamarack swamp, fourteen miles south of Brockport, N. Y. From New York its range extends westward to Utah and Montana, and from Ontario, Canada, south to Georgia. Edwards' rattlesnake, *C. Edwardsii*, although described as a native of Texas and Mexico, has lately been found in company with the massasauga in Bruce Co., Ontario. It seems to be only a variety between the prairie rattler and the following. 10. Southern ground rattlesnake, *Crotalophorus miliarius,* is found from North Carolina to New Mexico, and southward. *C. consors* is an accidental variety from Texas.



1. Eastern rattlesnake. 2. Massasauga. 3. Water moccasin. 4. Harlequin snake.

POISONOUS SERPENTS OF THE UNITED STATES.

To *Ancistrodon* belong the pit vipers without the rattle—the copperhead and moccasins. (See Fig. 3.)

11. The copperhead, *Ancistrodon contortrix*, has been found from Vermont to Florida, and westward to Kansas. 12. The water moccasin, *A. piscivorus,* is said to be found from North Carolina to the Gulf, and westward to Texas and Arkansas. Two years ago an ornithologist captured what he declared to be a true moccasin in a swamp in southern New Jersey. He sold the specimen to a dealer in objects of natural history. When I called to examine it, I found it had been bought by some unknown person, and all trace of it was lost. Mr. G. was a member of the Philadelphia Academy of Natural Sciences, and had ample opportunity to identify his specimen. I can find no records of it occurring north of the State of North Carolina. The mountain moccasin, variety *atrofuscus*, is found in the mountains of North Carolina and Tennessee. The Texan moccasin, variety *pugnax*, occurs in Texas only.

In the harlequin snakes, *Elaps*, the neck is not contracted as in the foregoing genera, but in most cases is continuous with the head and body. (See Fig. 4.) The upper jaw on each side is furnished with a small erect grooved fang. They are small snakes, not generally much over two feet in length, and are beautifully annulated with carmine red, black, and yellow rings. Although belonging to the same family as the dreaded cobra of India, they are generally considered harmless, and it is said they never attempt to bite, even though handled. Audubon says that formerly it was the fashion for Indian girls of Florida to decorate their hair with these brilliant little serpents; and in many places they are known as "bead snakes."

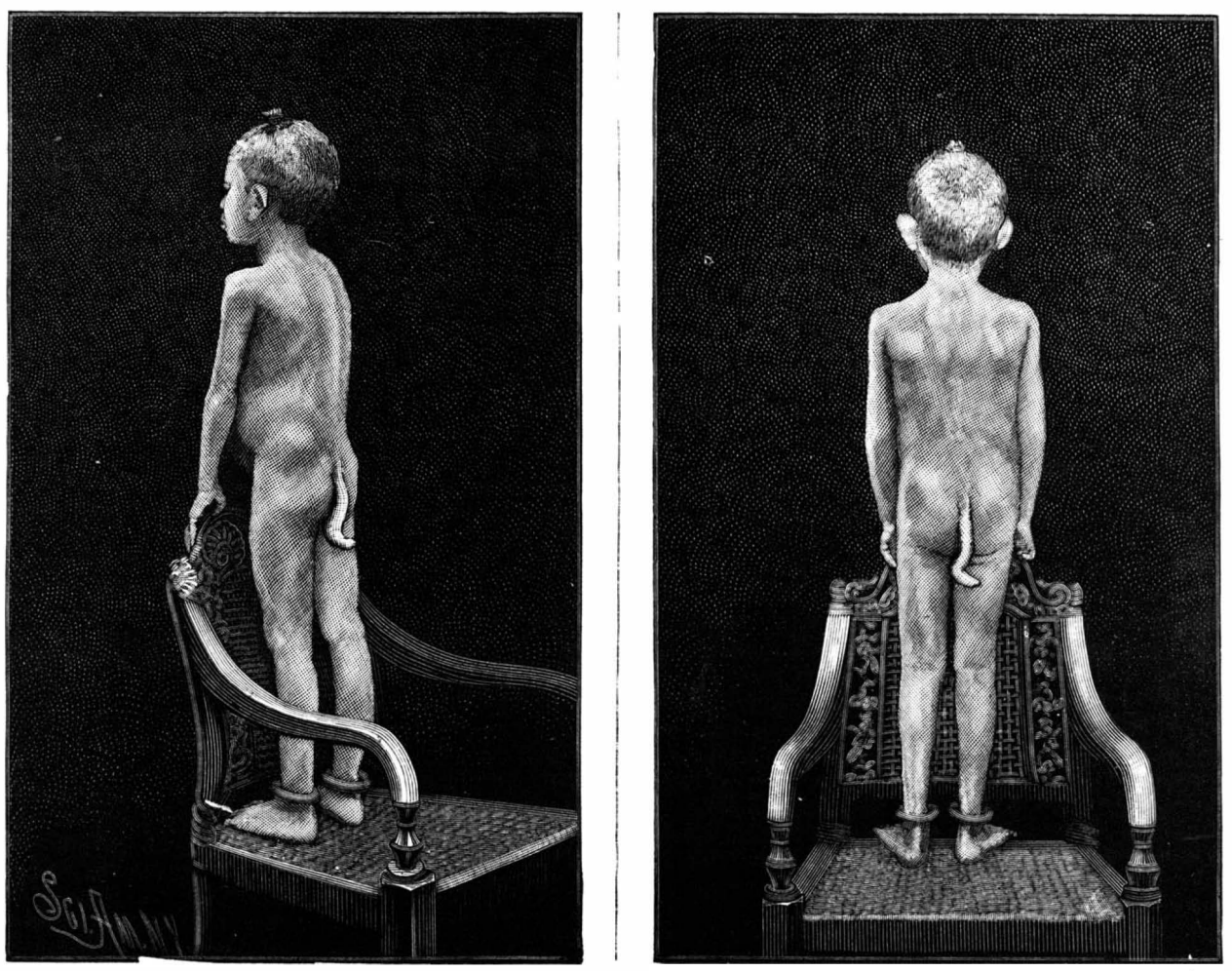
13. The common harlequin snake, *Elaps fulvius*, is found from South Carolina to Florida and Texas. Variety *tener*, of Baird and Girard, occurs in Texas, Mexico, and Florida. 14. Kennicott's harlequin snake, *Elaps euryxanthus*, inhabits Arizona and Mexico. *E. distans* has been found in Mexico and Florida; it appears to be merely a variety of *fulvius*, and not a distinct species.

The above list includes all the well-founded species of venomous serpents found in the United States; and it is not probable that many more names will be added in the future, as all the States and Territories have been well ransacked with the hope of finding "new species."

In nearly every section of country the natives will point out snakes which they "know for certain are awful poisonous," but which are, in reality, as harmless as a duckling. Take the hog-nosed snake or "blowing viper," *Heterodon platyrhinus*, for example; in one part of the country the rustic will declare to you that "that wiper am fearful wenomous," while in another section you will be informed that it is "a hog snake and ain't poisonous." By the way, this snake varies greatly in color, being found uniform black to pale yellowish brown with brown blotches. It can always be distinguished by its turned-up, hog-like snout and the manner in which it can flatten or spread itself and blow when approached. By some it is called "the spreading adder."

It is often a very repulsive and formidable-looking snake, and the additional fact that the posterior teeth in the upper jaw are long and fang-like has caused even educated persons to consider it venomous. Sometimes it has a curious habit of feigning death when pushed about with a stick or your foot—a habit which I have not observed in any other snake. At such times it throws itself over, assumes a *rigor mortis*, dislocates the lower jaw, becomes motionless, and to all outward appearances seeming as though the last spark of life had vanished. The unknowing person would imagine that a very tender spot had been touched which caused instant death. But when it sees the intruder at a safe distance—a snake always sleeps and dies with its eyes open—it quickly glides away to a place of safety. I know one instance where one of them permitted itself to be completely buried in sand without showing the least sign of life, but after a few minutes, when it supposed the unwelcome visitor had left, slowly pushed its head out of the sand, and not seeing the hidden yet observing enemy, slowly crawled out and began moving off.

The common garter or ribbon snake is rightly considered harmless, and yet the following clipping from a South-



A MOÏ BOY WITH TAIL NINE INCHES LONG.—(Engraved from a photograph.)

[FOR DESCRIPTION SEE PAGE 296.]

© 1889 SCIENTIFIC AMERICAN, INC.

ern paper may be perfectly true: "A negro child on the plantation of Dr. B. R. Rieves, of this county, came to its death one day recently under peculiar circumstances. It seems that a cat had caught a garter snake and carried it into the house, where the child was sitting alone on the floor. The child in admiration for the snake took it up in its hands and was bitten by the reptile on the arm, and from the effects of the bite the child died."—*Dawson Journal.* This instance, however, does not prove that the garter snake possesses poison fangs and glands. Numerous cases are on record where the scratch of a pin, the puncture of a splinter, nail, or tack have caused death to man, yet we certainly do not consider a chip of wood or a tack articles of venom and death. I have seen many bites or scratches made by the teeth of garter and water snakes, and have been bitten myself, yet the scratches were less severe than the wounds we sometimes receive from thorns in plucking June roses. C. FEW SEISS.

CAUDAL APPENDAGE IN MAN.*

Naturalists have up to the present time given little attention to the study of tailed men. Such an organ has simply aroused the curiosity of any one who has seen a specimen, quite as a bearded woman arouses interest in a dime museum. The works on this subject are very incomplete, a few lines here and there scarcely throwing any light on the subject. There is one monograph † on this subject. There are few documents on the subject, the monstrosity is seldom found, and few of the well known cases could bear a close scrutiny.

It is not our intention to translate or give an abstract of this German production, but we have the good fortune to be able to reproduce an engraving from two very good photographs taken from life, and we shall accompany them with a few descriptive words.

A number of travelers in South Africa have testified to the existence of men of the Nyams-Nyams tribe who had tails. This may or may not be true. If such is the case, Mr. Quatrefages does not consider that the evidence to that end is very trustworthy, and rather comes to the conclusion that it has not been absolutely proved, although he believes the fact not improbable. Mr. Ecker, on the contrary, after examining this subject thinks that the testimony of explorers is credible.

Although there may not be a race of human monkeys, it must be admitted that there are some cases of individuals having a caudal appendage. When I say "some" cases, it should be understood that Pliny and Ptolemy, and after them Marco Polo, Strup Maillet, and others, speak of this anomaly, and their citations would comprise in all not 15 or 20 cases, but from 150 to 200. The well authenticated cases, however, are very few in number.

Bartels enumerates and describes twenty-one cases, which he classifies as: 1. Tail connected with body. 2. Tail with free movement. 3. Cutaneous prolongation. The first includes the triangular base bone unusually developed, and which extends to the anus and partially covers it. The second includes those tails that form a sort of projection at the back, and which separate from the body at the sacrum. The third will not be reviewed, as it does not seem necessary, as it could take either of the other forms mentioned and still be simply a cutaneous prolongation.

The specimens already observed enable us to give a general description, which will be done, however, with due caution. The tail is conical or spherical in shape, rarely cylindrical. The end nearly always curls slightly and sometimes is twisted like that of a pig. It is seldom more than 3 or 4 inches in length. It is sometimes covered, and sometimes it is quite smooth. In the former case the hair grows in places and resembles somewhat the tail of a cow. Bartels cites and has shown a case of this kind, while Quatrefages, who lived before his time, had considered this condition as a mere legend.

Whether these tails are soft or rigid, they possess in general no movement of their own. This physical peculiarity is usually accompanied with some other defect, with *atresia ani* in particular, and almost always with general constitutional weakness. Such are the general characteristics of this class of monstrosities. Can the cause of this be discovered? *Adhuc sub judice lis est.* Bartels considers that it is due to imperfect development, induced perhaps by inheritance from an ancestral type, while Quatrefages had not believed in this, but considered that it was caused by some abnormal development in the embryo. It is not for us to decide which theory is to be accepted. It is a curious circumstance, however, that this peculiarity is found principally among the male species. I do not think that the females of the lower orders are less favored in this respect than the males. It is also curious that the white races appear not to be privileged in this respect. If we admit that they are a superior race to the others, then perhaps atavism would explain it. In none of the cases that have been examined, however, could vertebræ be found in the tail; while the specimen that was dissected by Virchow simply consisted of fat and muscles. Atavism would explain alone the existence of an hereditary monstrosity.

The question of heredity was, at an early day, discussed by Mr. De Quatrefages. He came to the conclusion that such an organ, whatever its origin might be, could be transmitted from father to son. Such a conclusion is affirmed in the cases of other monstrosities in which this is found to be the case. The subject of the engraving, however, which we have not as yet described, is a very remarkable case. He is a young Moi, twelve years of age, who was taken to Saigon some time ago, where he was examined and photographed. Although so young, his tail was already nearly a foot in length. With the exception of its great length, this specimen resembled in almost every other respect those that had been examined by Bartels. From the information we have been able to procure, it appears that the organ is soft and smooth and has no bony frame. Bartels cites only four cases of this kind, while its cylindrical shape appears to be very rare. We stated above that, as a rule, this peculiarity was accompanied with other malformations, and such is found to be the case in the present instance. By examining the photograph it will be observed that a small mound or bunch is found upon each buttock. The shoulder blades seem to project abnormally, but it should be borne in mind that the subject is very thin.

The tail seems ordinary and possesses none of the peculiarities described by Mr. De Quatrefages. He describes tails two or three inches in length, while Bartels describes them as long as five inches, but this young Moi's tail is about ten inches in length. Therefore, up to the present time this is the best specimen on record. This matter ought not to be passed over carelessly, but it merits a thorough and complete investigation and study which should be no longer neglected.

* Etienne Rabaud in *La Naturaliste.*

† Max Bartels, Ueber Menschenschwanze, Archiv fur Anthropologie, 1880, p. 1 a 41, 1 pl.

Laws of Heat.

Heat is transmitted in three ways—by *conduction*, as when the end of a short rod of iron is placed in a fire and the opposite end becomes warmed—this is conducted heat; by *convection* (means of currents), such as the warming of a mass of water in a boiler, furnace, or saucepan; and by *radiation*, as that diffused from a piece of hot metal or an open fire. Radiant heat is transmitted like sound or light, in straight lines in every direction, and its intensity diminishes inversely as the square of the distance from its center or point of radiation. Suppose the distance from the center of radiation to be 1, 2, 3, and 4 yards, the surface covered by heat rays will increase 1, 4, 9, and 16 square feet; the intensity of heat will diminish 1, $\frac{1}{4}$, $\frac{1}{9}$, and $\frac{1}{16}$, and so on in like proportions until the heat becomes absorbed, or its source of supply stopped.

Whenever a difference in temperature exists either in solids or liquids that come in contact with or in close proximity to each other, there is a tendency for the temperature to become equalized; if water at 100° be poured into a vessel containing an equal quantity of water at 50°, the tendency will be for the whole to assume a temperature of 75°; and suppose the temperature of the surrounding air be 30°, the cooling process will continue until the water and the surrounding air become nearly equal, the temperature of the air being increased in proportion as that of the water is decreased.

The heat generated by the fire under a boiler is transmitted to the water inside the boiler, when the difference in the specific gravities, or, in other words, the cold water in the pipes, being heavier than that in the boiler, sinks and forces the lighter hot water upward. This heat is radiated from the pipes, which are good conductors of heat, to the air in the room, and raises it to the required temperature. That which absorbs heat rapidly parts with it rapidly, and is called a good conductor, and that which is slow to receive heat parts with it slowly, and is termed a bad conductor.

The following tables of conductivity, and of the radiating properties of various materials, may be of service:

CONDUCTING POWER OF VARIOUS SUBSTANCES.—DESPRITZ.

Material.	Conductivity.
Gold	100
Silver	97
Copper	89
Brass	75
Cast iron	56
Wrought iron	37
Zinc	36
Tin	30
Lead	18
Marble	2·4
Fire clay	1·1
Water	0·9

RADIATING POWER OF VARIOUS SUBSTANCES.—LESLIE.

Material.	Radiating Power.
Lampblack	100
Water	100
Writing paper	98
Glass	90
Tissue paper	88
Ice	85
Rough lead	45
Mercury	20
Polished lead	19
Polished iron	15
Gold, silver	12
Copper, tin	12

From the above tables it will be seen that water, being an excellent radiator and of great specific heat, and cast iron a good conductor, these qualities, together with the small cost of the materials, combine to render them efficient, economic, and convenient for the transmission and distribution of artificial heat.

Heat is a word freely used, yet difficult to define. With a temperature of 65° to 70° we frequently hear it remarked, "How hot this room is! It is insufferable." Water at the same temperature would be described as cold; a temperature of 90° in the shade we call "intensely hot." We should speak of water at this temperature as scarcely warm; a smith would rarely consider his iron hot if less than 800° (red heat), and would call it a good heat at 2,700° (welding). It would appear paradoxical to speak of heat and cold as synonymous terms, yet what we frequently call cold is only another term for a low degree of heat. The word "heat" is commonly used in two senses: (1) to express the sensation of warmth; (2) the state of things in bodies which causes that sensation. The expression herein must be taken in the latter sense. By adopting certain standards we are enabled to define, compare, and calculate so as to arrive at definite results, hence the adoption of a standard unit of heat, unit of power, unit of work, etc.

The standard unit of heat is the amount necessary to raise the temperature of 1 lb. of water at 32° Fahr. 1°, *i. e.*, from 32° to 33°.

Specific heat is the amount of heat necessary to raise the temperature of a solid or liquid body a certain number of degrees; water is adopted as the unit or standard of comparison. The heat necessary to raise 1 lb. of water 1° will raise 1 lb. of mercury about 30° and 1 lb. of lead about 32°.

Table of the Specific Heat of Equal Weights of Various Substances.

	Specific Heat.		Specific Heat.
SOLID BODIES.		LIQUIDS.	
Wood (fir and pine)	0·650	Water	1·000
" (oak)	0·570	Alcohol	0·598
Ice	0·504	Acid (pyroligneous)	0·590
Coal	0·280	Ether	0·520
Charcoal (animal)	0·260	Acid (acetic)	0·509
" (vegetable)	0·241	Oil (olive)	0·309
Iron (cast)	0·241	Mercury	0·033
Coke	0·201		
Limestone	0·200		
Glass	0·195		
Steel (hard)	0·117	GASES.	
" (soft)	0·116	Hydrogen	3·409
Iron (wrought)	0·111	Vapor of alcohol	0·547
Zinc	0·095	Steam	0·480
Copper (annealed)	0·094	Carbonic oxide	0·245
" (cold hammered)	0·093	Nitrogen	0·243
Tin	0·056	Oxygen	0·217
Lead	0·031	Atmospheric air	0·237
		Carbonic acid	0·202

—*Ironmonger.*

Acrophobia.

BY WINSLOW ANDERSON, M.D.

Among the many curious psychical experiments that are now attracting the attention of scientific minds, the one to which the term "acrophobia" has been applied has several points of interest. In referring to the term and phenomena, *Science* for January, 1889, defines it as an exaggerated condition of fear.

Dr. Verga has recently described the phenomena in his own case:

Though by nature not at all timid, all his courage leaves him when above ground. He complains of palpitations in mounting a step-ladder, for instance; finds it extremely unpleasant to ride on the top of a coach or even to look out of a first story window. This idiosyncrasy forbids him the use of an elevator, and the mere thought of those who have cast themselves down from high places causes tingling all over his person. His acrophobia even goes so far that the thought of the earth spinning through space is enough to cause discomfort.

Persons on a bridge high above the water, or on a cliff, or high up in a tower, are frequently overtaken by not only exaggerated fear, but by *abnormal* fear, producing at times dizziness and even faintness. Another class of individuals are seized with an intense and, at times, an uncontrollable desire to jump down from any height which they may have reached.

A greater or less degree of this fear seems quite common and perfectly compatible with normal mentality. —*Pacific Med. Jour.*

A Scientific Hotel Keeper.

Mr. E. S. Chapin, who died in Springfield, Mass., a few days ago, in his seventy-fourth year, not only made for his hotel, the Massasoit House, an almost national reputation, but was much interested in scientific subjects, and for forty years a reader of the SCIENTIFIC AMERICAN. In 1864 he published a pamphlet entitled "Gravity and Heat," and three years later, with the assistance of his daughter, Mrs. Haile, expanded his theory into a book of 120 pages, called "The Correlation and Conservation of Gravitation and Heat, and some of the Effects of these Forces on the Solar System." In 1887 he published "Gravitation the Determining Force." Williams College gave him an honorary degree of A.M. for his investigations.

© 1889 SCIENTIFIC AMERICAN, INC.

CRUDE PETROLEUM FOR MANUFACTURING PURPOSES.

We illustrate herewith some of the many uses made of crude petroleum as fuel by the processes of the Aerated Fuel Company, of Springfield, Mass.

Fig. 1 shows the application of this system under a boiler, return flue pattern. Among the many advantages claimed by this system over coal are: Uniform heat, constant pressure of steam, no ashes, clinkers, soot or smoke, and consequently clean flues, one man attending from ten to fifteen 100 H. P. boilers burning this fuel easier and with less trouble than with one boiler burning coal.

Fig. 2 shows this system as applied to a forge suitable to a large variety of general work. One cylinder containing six burners is placed on one side, leaving one end open to receive the work. If desirable, both ends may be left open, especially when it is desired to heat long pieces of iron or steel in the center. By putting an adjustable or movable brick partition in the center, as many burners as are not wanted can be shut out, thus reducing the area of the fire box and using one or two burners, as required. At the repair shops of the Boston & Albany Railroad Company, at Springfield, Mass., where this system is generally employed, the superintendent states he regards the system as far superior to coal in every respect, particularly for work requiring a high degree of heat at short notice.

Fig. 3 illustrates the interior and end view of the burner cylinder and shows the proper position of float valve when cap is on end of cylinder.

The object of the float is to prevent the flowing of oil into the cylinder and rising above the mean level as established by the governing device in each cylinder. The float falls of its own weight, so as to open the valve and allow the oil to rise again to the mean level. The sectional cuts show that if, from any cause, the float should sink, it will also close the valve, thus preventing any possibility of flooding the furnace or overflow in tanks.

Referring to Fig. 3, it will be seen there is an air space maintained on an air pressure of from 10 to 25 lb. per square inch, according to the class of work being done. Although the nozzle of the burner is small, from 1-20 to 1-8 inch, and only a small quantity of air used, yet it must be under an equal pressure, that the oil may be finely atomized before igniting.

The Aerated Fuel Company have many forges, muffles, ovens, and similar fires, using over 1,500 burners, in successful operation, in which the fuel is crude Lima oil, burned by being atomized with a governed air pressure, very similar in quality to natural gas and free from danger. Its advantages are, no increased rates of insurance, for the best insurance companies approve of the system as shown in Fig. 2; no odor; no chimney connection needed; no sulphur or other impurities, as is the case with coal; perfect combustion and regulation; and cheaper than any fuel, not excepting natural gas, unless the consumer owns his own wells.

One pound of oil will do the work of from 3 to 6 lb. of the best hard coal in forges, and do it better, and there is less liability of overheating or burning stock.

The system can be adapted to nearly any forge now in use, but as it is necessary to use from 10 to 25 lb. air pressure per square inch, a compressor of some kind is necessary, as no fan blower will maintain this pressure. The oil ceases to flow through the burner when the air pressure is removed, consequently fire is impossible, and only one valve is necessary to control both oil and air. This process is already used for japanning, annealing, hardening, drop forging, shovel welding, heating blanks for bolts, riveting furnaces for boiler and bridge work, hoe, fork, and rake work, cutlery works, mowing, reaping, harvesting, binding, and hay pressing machinery, scale work, railroad repair and locomotive works, glass and copper works, etc.

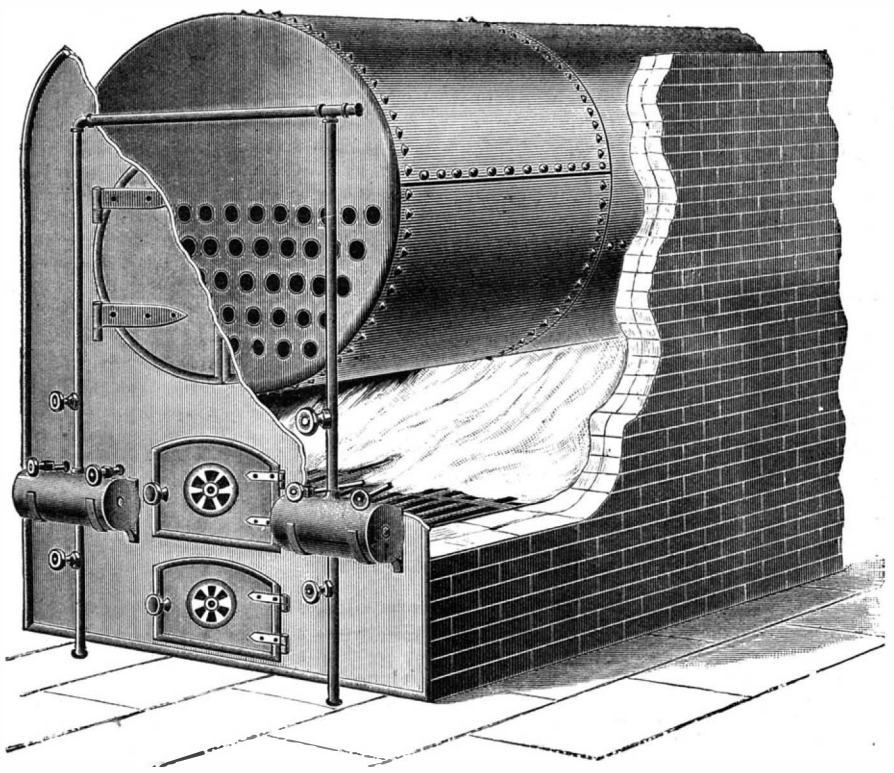


Fig. 1.—BURNING CRUDE OIL UNDER A BOILER RETURN FLUE PATTERN.

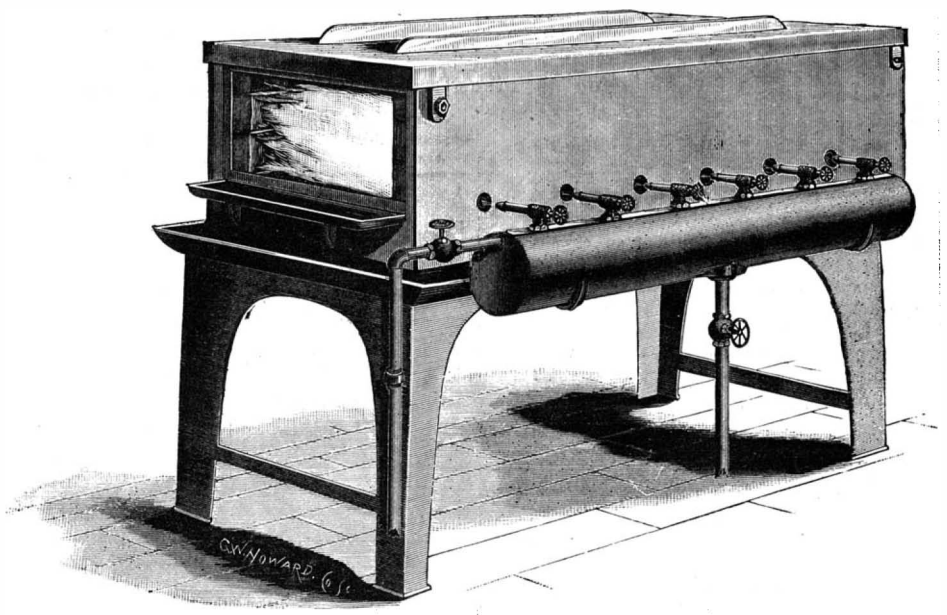


Fig. 2.—BURNING CRUDE OIL UNDER A FORGE FOR GENERAL WORK.

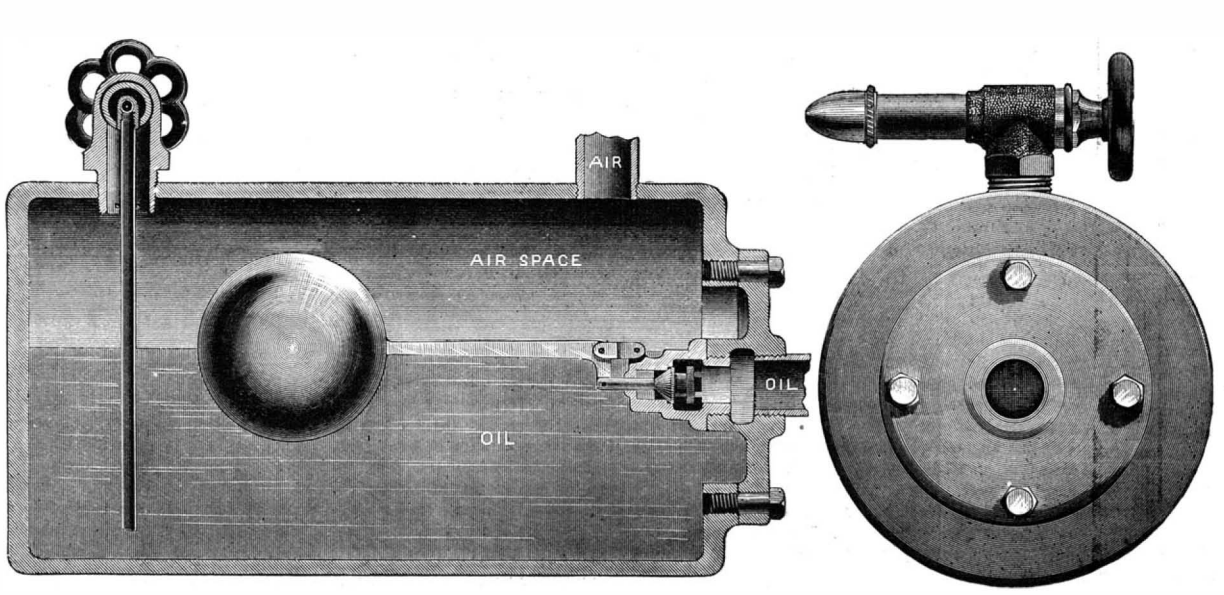


Fig. 3.—INTERIOR AND END VIEW OF BURNER CYLINDER.

On Artificial Organic Dyestuffs and Their Use.

In *calico printing* the dyestuff solutions are mixed with a thickening (starch paste, gum tragacanth) and if necessary a mordant, and applied to the fiber by means of printing blocks or rollers. Then usually follows steaming, whereby the dyestuff and mordant are caused to penetrate the fiber and combine with it. When albumen colors are employed, the albumen, which at the beginning is soluble, coagulates by the steaming process and in this state holds the dyestuff fixed upon the fiber.

Leather dyeing is on the whole based upon the employment of the same dyestuffs which are used for dyeing animal fibers, such as the eosines, fuchsines, methyl violet, malachite green, acid green, quinoline yellow, ponceaux, nigrosine; but also dyestuffs which are specially used in cotton dyeing, such as phosphine and methylene blue. It must be observed, however, that the colors obtained upon leather do not always match those which are produced with the same dyestuffs upon fibrous material. Prior to dyeing the leather must be very carefully cleaned. The dyeing operation consists either in immersion in a dyestuff solution or in the application of the baths by means of brushes. In the latter case aqueous as well as alcoholic or lake solutions are used.

The dyeing of feathers and hair is effected by first cleaning the feathers or hair, before dyeing, or bleaching if necessary, by lukewarm soda water (1:120). For dyeing, all neutral dyestuffs suitable for wool dyeing are employed in the same manner as for this fiber.

The dyeing of horn, bone, ivory, and ivory nuts is ordinarily effected, after cleaning, by laying them down in the suitable dyestuff solutions, or painting with them.

Straw is dyed in the same manner; before dyeing, however, it must be cleaned by laying it down in ammonia or soda solution. Usually it is previously bleached by sulphurous acid.

Wood, grasses, flowers, moss, etc., are stained by laying the objects to be colored down in the solutions, or painting them over, or pressing the coloring liquid into them. The most used colors are fuchsine, methyl violet, malachite green, and aniline blue.

The staining of paper with the artificial organic dyestuffs constitutes an extensive industry on account of the handsome and bright colors obtained and of the simplicity of the dyeing methods, of which two are distinguished, viz., staining in the sheet, when the paper is either immersed in the dyestuff solution or painted over with the same (or with colored lakes), and coloring in the pulp, when the dyestuff is already added to the paper stuff while in the rag engine. Paper can, besides, be printed with colors like tissues, as in the manufacture of wall paper.

For coloring soaps only dyestuffs are used which are soluble in alkaline liquids and are not altered thereby.

Colored varnishes or so-called brilliant lacquers are produced with aniline dyestuffs soluble in alcohol, such as fuchsine, methyl violet, azo and nitro dyestuffs soluble in alcohol, etc.

For colored inks many artificial organic dyestuffs are excellent to use on account of their great tinctorial value, and because the aqueous solutions do not become mouldy. For 3 pts. dyestuff generally 5 pts. gum arabic and 150 pts. water are used, and for copying inks some glycerine is added. Methyl violet is preferably used for violet (mauve) ink, eosine for red, and malachite green for green ink. For making marking ink (stamping) 3 pts. dyestuff are mixed with 144 pts. alcohol 50 per cent and 33 pts. glycerine.

Ink sticks were first, in 1878, produced by E. Jacobson, from aniline dyestuffs, graphite, and kaolin. These materials are mixed in four different proportions, according to the degree of hardness desired; the more kaolin and the less dyestuff and graphite, the harder the stick. The finely ground materials are carefully mixed, made into a paste with water, pressed through a perforated plate so as to form sticks, and dried.—*Textile Colorist.*

Turpentine Baths for Rheumatic Pains.

Make a concentrated emulsion of black soap, 200 grammes, add thereto 100 or 120 grammes of turpentine, and shake the whole vigorously until a beautiful creamy emulsion is obtained. For a bath take half of this mixture, which possesses an agreeable pine odor. At the end of five minutes there is a diminution of the pains, and a favorable warmth throughout the whole body. After remaining in the bath a quarter of an hour, the patient should get into bed, when a prickling sensation, not disagreeable, however, is felt over the entire body, then, after a nap, he awakens, with a marked diminution in the rheumatic pains.—*Prat. Med.*

© 1889 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE. — Marcellus A. Buford, Thompson's Station, Tenn. The casing has steam inlet and exhaust chambers, a main driving shaft being mounted to rotate in the casing, while a wheel with central disks having inlet openings in their peripheries is secured on the shaft, exhaust disks being secured to the central disks, and the construction is adapted for the use of steam, air, water, or other suitable fluid.

Railway Appliances.

CAR COUPLING.—Josiah Poffenbarger, York, Neb. This device is designed to act automatically, the bumpers having transverse stationary rods combined with a locking hook with pivoted head and curved lower end, the locking lever having a spring bolt at its forward end, with other novel features, the construction being simple, strong, and cheap.

CAR COUPLING.—John J. Jeter, Campbellsville, Ky. This coupling acts automatically, and the improvement is applicable to the ordinary drawheads, the link being adjustable up or down as desired, while the drawhead is preferably secured to the car so that it may move longitudinally back against a spring when it strikes another drawhead.

Mechanical.

WRENCH.—Sidney Cook, Orlando, Fla. This improved wrench is of simple construction, and so made that one jaw will be removable and adjustable, while the movable jaw may be placed at various angles with respect to the fixed jaw and adjusted laterally while in any position.

COMBINATION TOOL. — Samuel L. Heinold, Anderson, Ind. This invention covers a tool comprising a hammer, crosscut-saw set, and gauge and is made also to hold a file for dressing and pointing saw teeth all to a uniform length.

NUT LOCK. — Isaac F. Leiby, Baird, Texas. Combined with a loop-formed nut-locking device, and the plate to which it is hinged, is a supplementary locking device, consisting of a wire or rod having one end bent at right angles and embracing the hinge of the main device, while its other end is provided with a hook to receive the side bar of the main device.

DOFFER CLEANER. — George Bebb, Indianapolis, Ind. This is a cleaner for carding machines working on woolen and cotton fibers, and the invention relates to that class of cleaners in which a cleaner bar having card clothing is supported so that it may be swung alternately in contact with the doffer and with the stripping bar, the mechanism being such that the cleaner need not be continuously operated, but only at such intervals as may be found desirable.

BARKING AND SPLITTING MACHINE.—Otis W. Stearns, Johnson, Vt. This machine has a vertically reciprocating barking knife and a vertically reciprocating splitter, both operated from one drive shaft at different speeds and arranged in proximity to each other, whereby as the log is barked it may be convenient to the splitter knife.

Miscellaneous.

SEWAGE PURIFIER.—James J. Powers, New York City. By this invention the sewage is supplied with lime at intervals and precipitated, the effluent flowing off at the end of the apparatus, while the sludge and solid matter remains to be removed at intervals, the sewage being held in a quiescent state while settling, the flow being intermittent to and from the settling tanks and automatically regulated at given quantities.

SHAFT SUPPORT.—Edward Clark, New York City. This is a device for taking off the weight and strain from the back of a horse hitched to a vehicle, a plate being hinged on the vehicle to engage the transverse beam of the shafts, the free end of such pivoted plate resting on a screw, which is adjustable to suit the height of the horse.

HYDROCARBON BURNER. — Graves Griffith and Theodore L. Miller, Blanchard, Iowa. This burner is especially adapted for furnaces, stoves, etc., although its principle may likewise be applied to a safety lamp, it being designed to secure safety against explosion of accumulated gas and complete control of the oil supply, while the amount of burning surface is regulated, and the requisite amount of air is fed to the burning oil or fuel.

CURRENT PROPELLER. — Ernst Lotze, Spokane Falls, Washington Ter. A chain anchored at one end up stream, where there is a current, is passed through the boat from stem to stern, in close engagement with a shaft on which are side wheels dipping into the water, the design being that the revolving of the paddle wheels by the current will operate to pull the boat, by means of the chain, up stream.

ELECTRIC LANTERN. — Charles W. Cox and Thomas E. Van Dyke, Philadelphia, Pa. Combined with a suitable casing containing a battery is an automatic switch arranged to close the circuit as the top of the casing is opened and open the circuit when the casing is closed, a lamp being placed in the circuit in convenient position for use, making a lamp adapted for use where a flame would be unsafe.

"PICKING" THIMBLE FOR STRINGED INSTRUMENTS.—Norman E. Barnes, Bay Shore, N. Y. This thimble is preferably made of metal, with a tubular split portion, whereby it may be readily slipped over a finger or thumb, and a rounded point which engages the strings of a stringed musical instrument in performing thereon.

DREDGING BUCKET. — Rezin Hosford, Lebanon, Ind. The frame of the implement consists of a head, upon each extremity of which two arms are pivoted, extending downward and outward in opposite directions, and carrying shovel blades, with other novel features, the object being to provide an implement of simple construction to dredge oysters, gravel, sand, etc., in which the jaws of the bucket may be closed prior to being lifted.

SCRAPER.—Etienne L. Lefebure, New York City. This is a tool for scraping wood and other surfaces, being specially designed for plasterers' use in cleaning mouldings, its blade having a central horizontal portion and edge portions inclined thereto, one of which edge portions has a beveled scraping edge and the other a scraping edge formed with short teeth, the blade being detachable for sharpening or repairing.

PRINTERS' KNIFE. — Louis J. Dus, Milwaukee, Wis. This is a knife with extensible blades arranged at opposite ends of its handle, presenting a series of sharp cutting edges, for the convenience of a pressman in cutting out "overlays" or "underlays" in making a form ready to work, and making a tool better suited to such work than the ordinary pocket knife.

TOBACCO PRESS.—Irving A. McKinley, Cicero, N. Y. This is a portable press especially adapted for packing leaf tobacco in boxes for shipment, the press being quickly applied to and detached from the box or case, the invention obviating the necessity of the lifting and handling of the boxes necessary under former methods of doing the work.

LOAD BINDER. — Thomas A. Rogers, Bloomdale, Ohio. This device is designed especially for tying or binding a load of logs, a curved arm being pivoted to a head having a handle, and a grab hook linked in the outer extremity of the arm, whereby each end of a chain will be carried in opposite directions and the body of the chain made to firmly bind upon the load.

VEHICLE BODY.—Lafayette A. Melburn, Denver, Col. The panels of this body have their meeting ends formed with dovetail grooves and ribs, pins being driven partially in each of the panels at their joints, while dovetail grooves are fitted to receive the seat posts, which are fitted in the grooves, and the sills secured to the inner sides of the panels.

TYPE WRITING MACHINE. — Lebbens G. Garrett, Bissell, Pa. This is a machine by which whole words or phrases may be printed at once on the same line across a page and at a reporting speed by depressing keys of a key board conveniently arranged at the front of the instrument, the machine having oscillating type carriers and connected keys operating upon them to bring the type into line.

SCIENTIFIC AMERICAN BUILDING EDITION.

MAY NUMBER.—(No. 43.)

TABLE OF CONTENTS.

1. Elegant plate in colors, showing elevation in perspective and floor plans for a dwelling costing four thousand dollars. Page of details, etc.
2. Plate in colors of a summer cottage for one thousand two hundred dollars. Floor plans and page of details.
3. Design for a bank building, with plan and view of interior.
4. Perspectives and floor plans of an elegant residence at Bell Haven Park, in Greenwich, Conn. S. Edwin Tobey, Boston, Mass., architect.
5. A mountain cottage lately erected at St. Cloud, Orange, N. J. Elevation and floor plans. Architect Mr. Arthur D. Pickering, New York.
6. A dwelling at Springfield, Mass. Plans and perspective elevation. Cost eight thousand five hundred dollars.
7. Engraving showing perspective elevation of a cottage erected at Roseville, N. J., at a cost of six thousand seven hundred and fifty dollars. Floor plans. F. W. Ward, architect, New York.
8. Illustration and floor plans of a combined school house and country cottage erected at St. Cloud, Orange, N. J. Arthur D. Pickering, New York, architect.
9. A residence at Springfield, Mass. Perspective elevation and floor plans. Cost three thousand five hundred dollars. J. D. & W. H. McKnight, architects.
10. A cottage built at Roseville, N. J., for six thousand seven hundred and fifty dollars. Elevation and floor plans.
11. A cottage at Holyoke, Mass., lately erected for Howard A. Crafts, at a cost of three thousand one hundred dollars.
12. View of Auburndale Station, Boston and Albany Railroad, with plan of station grounds. H. H. Richardson, architect.
13. Miscellaneous Contents: The final payment clause in building contracts.—The plan.—Bending wood. — The Stanford tomb. — Experiments with cement mortar.—The railroad in horticulture.—The improved "Economy" furnace, illustrated.—The Academy at Mount St. Vincent on the Hudson, N. Y.—Wrought iron and cement lined pipes, illustrated.—Sheathing and lath combined, illustrated. — Artistic wood mantels. — A new ventilating furnace, illustrated. — Creosote wood preserving stains.—Large trees.—Rotary cutting tools for working wood, illustrated.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural publication in the world. Sold by all newsdealers.

MUNN & CO., PUBLISHERS,
361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Needle slot screens and all kinds of mining screens. Robert Aitchison Perforated Metal Co., Chicago, Ill.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Mech'l draughtsman wants situation. "E. C.," box 773, New York.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., 11 S. 9th St., Philadelphia, Pa.

Wanted—The latest novelty for a corner store awning. L. H. Daloz, 510 Tremont St., Boston, Mass.

For Sale—Patent No. 400,571, "mirror attachment to opera glasses." See illustration, page 291.

For Sale—To Wire Fence or Lightning Rod Manufacturers—License to manufacture "Lightning Conductors for Wire Fences." Patented. See Sci. Am., April 27. Address F. E. Wood, Kingman, Arizona.

Steel name stamps (1-16, 3-32, or ⅛ in. letters), 15c. per letter. F. A. Sackmann, 16 Huron St., Cleveland, O.

For the latest improved diamond prospecting drills, address the M. C. Bullock Mfg. Co., Chicago, Ill.

For best casehardening material, address The Rogers & Hubbard Co., Middletown, Conn. Send for circular.

Water purification for cities, manufacturers, and private users. The only successful legitimate system. Hyatt Pure Water Co., 16, 18 & 20 Cortlandt St., New York.

——Ball Engine.——

Automatic cut-off. Ball Engine Co., Erie, Pa.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Screw machines, milling machines, and drill presses. E. E. Garvin & Co., Laight and Canal Streets, New York.

Billings' Double-acting Ratchet Drills. Drop Forgings. Bronze Forgings. Billings & Spencer Co., Hartford, Conn.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Safety Elevators, steam and belt power; quick and smooth. The D. Frisbie Co., 112 Liberty St., New York.

"How to Keep Boilers Clean." Send your address for free 96 p. book. Jas. C. Hotchkiss, 120 Liberty St., N. Y.

The best *Coffee* roasters, coolers, stoners, separators, polishers, scourers, glossing apparatus, milling and peaberry machines: also rice and macaroni machinery, are built by The Hungerford Co., 69 Cortlandt St., N. Y.

Lathes for cutting irregular forms. Handle and spoke lathes. I. E. Merritt Co., Lockport, N. Y.

For steel castings of best quality, write the Buffalo Steel Foundry, Buffalo, N. Y.

Planing and Matching Machines. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

NEW BOOKS AND PUBLICATIONS.

THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC AND PHOTOGRAPHER'S DAILY COMPANION. 1889. $1.00. Published by Henry Greenwood & Co., London, England.

This widely known annual, now in its twenty-ninth year, comes to us filled with a great variety and larger quantity of information more valuable to photographers than ever before. It has nearly four hundred pages of reading matter and one photographic illustration, and contains a very full explanation of the various formulas for printing with iron salts, such as making blue prints, printing blue or black lines direct on a white background, and directions for toning such prints. There are also a number of short illustrated articles, covering many subjects, together with reliable formulas and tables of great use to the photographer.

THE YEAR BOOK OF PHOTOGRAPHY. 1889. By Thomas Bolas. Piper & Carter, London. Pp. 216. Price $1.

This excellent annual, now in its thirtieth year, contains much practical information for the photographer. It has as a frontispiece a very fine specimen of a Woodbury type entitled "Group of Champion Great Danes," which are three handsome-looking dogs very artistically posed. The picture is reproduced from a negative by Thomas Fall. Among the useful articles is one "On the Preparation and Use of Gelatine Plates, for Transparencies," by W. K. Burton, which alone is worth the price of the book. There are illustrations of improved lamps for burning magnesium powder, descriptions of the carbon and photo-engraving processes, and under "Every-day Experiences and Processes" are several pages of formulas, illustrations of new devices, and other information of a very practical nature.

NATURALISTIC PHOTOGRAPHY FOR STUDENTS OF THE ART. By P. H. Emerson, B.A., M.A. E. & F. Spon, New York. Pp. 307, xii. Price $2.

This book contains a greater amount of information on the artistic elements to be considered in photography than any that we know of. The author, himself an artist, has elucidated very concisely, yet also very fully, the principles which should be kept in view in making artistic and attractive photographs. Accompanying the text are marginal notes of much convenience in attracting the eye to the special subjects considered on any one page. The work is divided into three books. The first treats of "Terminology and Argument," in three chapters. The second chapter relates to "Naturalism in Pictorial and Glyptic Art," explaining the various styles and schools of art. The third chapter is devoted to a full explanation of "Phenomena of Light, and Art Principles Deduced Therefrom." Book II. includes "Technique and Practice," covering a description of cameras and tripods, lenses, dark room and apparatus, studio and furniture, exposure, development, retouching, printing, enlarging, transparencies, mounting, preparing exhibits for exhibitions, and a very good explanation of the latest photogravure processes. Book III. is on Pictorial Art, and embraces such subjects as "Educated Sight," "Composition," "Out and Indoor Work," "Hints on Art," and "Decorative Art." Following this are some very good suggestions as to what photographic libraries should contain. In his introduction Mr. Emerson states that "to give the student a clear insight into the first principles of art is the chief aim of the book." In these days of amateur photography, when the mechanical and chemical manipulations necessary to obtain a good photograph are so easily acquired, a book like this, calling attention in simple language to the elementary conditions that should be observed in making artistic photographs, will be greatly appreciated. So far as the science of photography is described, enough is said to give the reader considerable general information, but we must take exception to the statement that lantern slides have no place in art. They are as truly useful in illustrating the composition of a picture as a sketch or painting; therefore we think they should be commended. The book as a whole is very well written, and will be an excellent guide to those desiring to learn the art principles of photography and its practice.

THE AMERICAN ANNUAL OF PHOTOGRAPHY AND PHOTOGRAPHIC TIMES ALMANAC. 1889. By C. W. Canfield. Scovill Manufacturing Co., New York. Pp. 328. Price $1.

A book full of the latest ideas, formulas, and descriptions of new apparatus, by American photographers. It contains thirteen full page illustrations by twelve different processes, also a complete record of American photographic societies, a list of books on photographic subjects published during the year, diagrams of shutters, dark rooms, and stereoscopic printing frames, articles on the "Making of Lantern Slides," by W. H. Raw, "Silver Printing on Plain Paper," by Charles L. Mitchell, M.D., the "Preparation of Specimens for Photo-micrography," by C. B. Longenecker, "Formulas for Various Kinds of Blacks," by C. C. Vevers, and a full description of "A Photo-Mechanical Printing Process for Amateurs," by Rev. W. H. Burbank. At the end of the book are very full tables, and formula of special value to either the professional or amateur photographer. A list of American patents on photographic subjects during the year 1888 is also given. The typography is of a superior character. There has seldom been issued a book so excellently printed and conveniently arranged as this appears to be.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published.

Address MUNN & Co., 361 Broadway, New York.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(776) F. M. D. writes: 1. Is there any way of preventing white holly in fretwork from turning yellow after it has been in use a short time? A. We cannot recommend any cure. Possibly sponging with javelle water might help it, but this would tend to destroy the glue. 2. Also do you publish or sell a small book called the French Polisher's Manual? I think I saw a reference to it in the Notes and Queries some time ago, but failed to find it again. A. We can supply the French Polisher's Manual. Price 25 cents. 3. Is there any preparation that can be applied to cotton covered wire, so that the insulation will remain good if placed in the ground? If not, what is the best kind of insulation for the purpose? A. We advise you to use gutta percha covered wire, or special underground cable. You will not be able to get any satisfaction out of cotton covered wire. 4. I have a number of jars of Grenet battery, zincs 1½ by 4 and carbons about the same size, made of light carbons. The jars hold about a quart. How many of these cells would be required and how should they be connected to run a three c. p. or five c. p. lamp? A. Use six couples for small lamp and ten couples for larger lamp, arranged in series.

(777) J. R. R. asks (1) why a telephone ear cup, made with same size and power magnet, wound with same size and amount of wire as the Bell, but in a wood case, does not work as well, or should it if properly made. A. It should make no difference. A wooden case works perfectly well. 2. Also give description of induction coil used with Blake transmitter. A. The primary is wound with No. 18 to 24 wire to ½ ohm resistance, the secondary with No. 36 wire to 80 ohms resistance. A core of fine iron wire in a cylindrical bundle is best.

(778) J. M. W. asks (1) for the cheapest artificial manner in which to freeze small quantities of water. A. Freezing apparatus are sold for this purpose. A simple method is to cool water by placing it in a tin vessel, surrounding the latter with cold water in which one-half its weight of nitrate of soda is dissolved. Then on repeating the operation with the cooled water as the solvent of more nitrate of ammonia, a second portion can be frozen. We fear that you will find little satisfaction in artificial ice making except with a regular machine. 2. Also if the water on melting will be as pure and wholesome as it was before freezing? A. Yes.

© 1889 SCIENTIFIC AMERICAN, INC.

(779) W. R. asks how to make a spark coil. A. Make a ¾ inch bundle of iron wire 8 inches long, wrap it with five pounds No. 20 magnet wire. It will with battery and proper appliances light gas, but not an oil lamp.

(780) J. S. writes: Is beef a more digestible meat than veal? A. Beef is far more digestible. 2. In which time about is the former, and in which time the latter digested? A. Beef—boiled 2 hours 45 minutes, roasted 3 hours. Veal—roasted 4 hours, fried 4 hours 50 minutes.

(781) O. H. P. writes: 1. What is the meaning of the words ampere and ohm? A. See answer to queries 236 (Jan. 26) and 427 (March 9). 2. Give a good receipt for making a copying pad which will not spoil in warm weather. I desire to make from 20 to 50 copies from one copy. A. See SUPPLEMENT, No. 438, which we can send you for 10 cents. Mix a very little oil of cloves with it for hot weather.

(782) S. H. G. writes: Referring to the SCIENTIFIC AMERICAN of January 21, 1888, page 42, Prof. Mendelejef's "theory of the formation or origin of petroleum," where does he place the laboratory—as low down as "Cambrian," or not? A. Far below any geological horizon, in the incandescent regions of the earth's interior.

(783) M. S. asks: What is the usual treatment of apatite to extract the phosphoric acid, and also about what per cent it usually carries? A. It is treated with sulphuric acid to convert it into a superphosphate.

(784) J. W. D. writes: 1. Will vapor gas such as used by gasoline stoves answer for heating purposes, either by hot water or steam? A. Yes; but it is dangerous, as involving the storing and handling of large amounts of naphtha. 2. Would it be as cheap as bituminous coal at $3 per ton or anthracite at $6 per 2,000 lb.? A. Probably it would prove cheaper, because so easily extinguished and started, and because of there being no ashes to dispose of, etc. 3. From what is the gas made that H. Disston is using for fuel in his saw works, and is it the same with which Westchester, Pa., is to be supplied for fuel? A. We cannot answer this. Address the party named. 4. What is the probable comparative cost of kerosene, or crude oil, or fuel gas, or coal for generating steam? A. Allow 3½ barrels of oil to the ton of coal, and 55 to 65 lb. of coal to 1,000 cubic feet of gas for equal calorific powers. From these figures make your estimates according to relative prices in your vicinity.

(785) R. T. F. writes: 1. Can you give me a good simple recipe for making a nice liquid or solid shoe blacking, that will produce a quick shine? A. Various receipts have been published in our Notes and Queries. We also refer you to "Trade Secrets," which we can supply for 60 cents by mail. 2. Can you tell me what makes my hands perspire while playing the violin, and can you tell me of a harmless remedy to prevent it? A. It is constitutional. Try bathing the hands in alcohol and use powdered corn starch or soapstone on them before playing.

(786) T. L. R. asks: Will the receipt No. 653 in April 20, 1889, issue, for gumming labels, do to use in fastening papers, such as a bunch of note or letter heads? If not, will you please give a good receipt? Something that does not require heating when to be used, cheap and gummy. A. No. The regular composition used is made from best glue and glycerine and water colored with aniline. This needs heating. A solution of gum tragacanth with a little glycerine might answer your requirements, but we advise the first. For 5 lb. of dry glue allow 1 lb. of glycerine.

(787) H. C. asks: 1. Is there a paper published, anywhere in the world, which is devoted entirely to the subject of "Aerial Navigation"? A. Yes; in France. 2. What is the lifting power of 1,000 cubic feet of what is called "water gas," being made from steam, coal, and naphtha? A. About twenty pounds.

(788) W. H. M. asks: Can you give me the formula of a liniment of which sulphuric acid is a component part? A. No officinal liniment of this character is given. A mixture of the strong acid with saffron, forming a paste, is a strong caustic which has been used successfully. It is very powerful, and must be used with caution.

(789) O. V. writes: 1. Can you inform me what sort of cement is used in wooden boxes to make battery cells? A. Have boxes perfectly dry, smear them inside with a hot mixture of four parts resin, one part gutta percha, and a little boiled oil. The mixture must be thoroughly melted and stirred before use. A hot rod of iron may be used to melt it into the crevices. 2. Are they only good for Bunsen batteries or Grenet? A. They can be used for any ordinary type of battery. 3. What are dry batteries composed of, and are they any good for a medical coil? A. A good effect can be obtained from a paste of plaster of Paris one pound, oxide of zinc one-fourth pound, saturated solution of chloride of zinc enough to make a stiff paste. They are very good for medical coils.

(790) L. W. asks: 1. How to wash copper wire with mercury. I wish to use it for internal use. A. Dip in mercury covered with dilute sulphuric acid. 2. Also, is mercury poison? A. Yes. 3. Also how to silver copper wire and pan. A. Best by electroplating described in our SUPPLEMENT, Nos. 157, 158, and 159.

(791) O. B. asks how rubber cement is made, such as is used for repairing rubber boots. A. For solution of India rubber see SUPPLEMENT, Nos. 249, 251, and 252. Gutta percha dissolved in bisulphide of carbon may answer your purpose.

(792) A. J. P. writes: What effect has mercury on a man's system, and the way to extract it? A. It produces salivation and tends to disturb the entire gastric and intestinal system, and in sufficient quantity and form acts as a strong corrosive poison. Local blood letting, demulcent drinks, etc., are applied after cases of mercurial poison. Its effects vary according to the form in which it is administered. In many cases, the effects of a disease which has been treated by mercurial medicines are considered the effects of the mercury itself. A physician should be consulted in all such cases. It probably does not remain long in the system.

(793) Constant Reader asks: Some years ago I had some talk in regard to albumen, caseine, etc., with Prof. Chas. Joy, and he referred to the extraction of albumen by using ozone generated by passing air through spirits turpentine, if I remember correctly. What I want to ask is, Is ozone generated in that way by any one? A. Turpentine has a bleaching action formerly attributed to the presence of ozone. This is now not credited, the bleaching power being supposed due to an organic compound, $C_{10}H_{14}O_4$. We have no record of ozone being thus successfully generated.

(794) An Old Reader asks for a good receipt for making honey, if possible, without using honey as one of the ingredients? A. 5 lb. white sugar, 2 lb. water, gradually bring to a boil and skim well. When cool add 1 lb. bees' honey and 4 drops peppermint. To make of better quality add less water and more real honey. Other formulæ are given in Dick's Encyclopedia, which we can supply for $5. 2. Would also like to know what the chemical composition of honey is. A. Principally of saccharine matter and water, about as follows: Levulose 38½ to 40 per cent, dextrose 31¾ to 39 per cent, water 20 to 30 per cent, besides ash and other minor constituents.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

April 23, 1889,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, purifying acetic, Bang & Ruffin 401,992
Alarm. See Burglar alarm.
Animal releasing device, G. A. Waterhouse 401,914
Animal shears, A. A. White 401,806
Annunciator drop, J. M. Stuart 402,043
Auger, post hole, H. C. Cloyd 401,999
Axle making machine, A. Paterson 402,101
Axles, making, A. Paterson 402,102
Barrels, mechanism for the manufacture of, W. H. Cram 401,981
Battery. See Galvanic battery. Secondary battery.
Bearing, ball, H. Kunath 401,748
Bearing, roller, R. W. Hent 401,884
Beehive, F. Dazenbaker 402,002
Belt, electric, C. H. Grimley 401,882
Belting for machinery, W. C. Edge 401,779
Binder, load, T. A. Rogers 401,857
Bit. See Drenching bit.
Blacking and polishing shoes, machine for, A. Kitson 401,890
Blast furnaces, flux feeder for, N. A. Pratt 402,103
Block. See Glass building block.
Block barking and splitting machine, combined, O. W. Stearns 401,866
Board. See Condenser switch board. Game board. Ironing board.
Boiler. See Steam boiler. Wash boiler.
Bombs, distributer for explosives, H. W. Parsons 401,851
Book, combined record and sales, Harsha & Duval 401,948
Book, pad, E. Schonacker 401,909
Book, school record, J. Du Shane 402,072
Bottle, J. Stone 402,042
Bottle stand, C. K. Hall 401,829
Bottle stopper, D. J. Corcoran 402,124
Bottle stopper, C. C. Haley 402,078
Bottles, stopper receiver for, A. T. Scher 401,760
Box. See Desk box. Display box.
Box fastener, J. L. Lillienthal 401,893
Brake. See Pump brake. Rail brake. Vehicle brake.
Brake, Massey & Normand 402,092
Brake mechanisms, automatic, pump governor for, G. Westinghouse, Jr 401,915
Brick machine, wire cut-off, S. W. Lasor 401,750
Bridge, pontoon, S. N. Stewart 401,765
Buildings or bridges, truss for, J. T. Wells 401,870
Bureaus, hanger for mirrors of, J. R. Anderson 401,921
Burglar alarm and testing system, F. H. Nutter 401,789
Burner. See Petroleum burner. Stove burner.
Buttonhole strips, making, M. P. Bray 401,995
Button hook and bracelet, combined, A. Johnstone 401,746
Button, separable, G. A. Schlechter 401,908
Button setting machine, J. H. Vinton 402,047
Cab, C. A. Reade 401,758
Cable grip, T. W. Lemieux 401,842
Cable grip, S. F. McDill 401,895
Camera. See Photographic camera.
Can. See Metal can. Milk can.
Can bodies, machine for applying heads to tin, W. Hipperling 401,886
Car coupling, J. Coup 401,775
Car coupling, J. J. Jeter 402,085
Car coupling, E. J. Knapp 402,021
Car coupling, J. Poffenbarger 401,854
Car, electric, J. W. Henderson 402,080
Car heater, H. Schreiner 401,794
Car heater, railway, R. M. La Rue 401,749
Car ventilator, Tappey, Jr., & Evans 402,044
Cars, letter box for street, G. B. McAllister 402,028
Cars, steam pipe coupling for railway, L. Aldrich 401,920
Caramel holder, G. W. & E. E. Chase 401,774
Card teeth, making, G. & E. Ashworth 401,991
Carding machines, doffer cleaner for, G. Bebb 401,811
Carriage, folding, J. F. Flad 401,939
Carrier. See Poultry carrier. Quilting machine shuttle carrier. Sheaf carrier.
Carriers, driving mechanism for endless, J. Dick 401,777
Cart, road, M. L. Cleveland 401,785
Cart, road, J. G. Hess 401,834
Cartridges, pocket for, G. Barnard 401,923
Case. See Knockdown case. Show and shot case. Typewriter case.
Ceiling, metallic, L. L. Sagendorph 401,906
Chain, W. C. Edge 401,935
Chair. See Convertible suspending chair. Reed chair. Reed or rattan chair.
Chairs, bellows attachment for rocking, F. Marschall 402,026
Chandelier, L. F. Griswold 402,077
Check protector, E. O. Abbott 401,871
Chimney, J. A. Hodel 401,836
Churns, motor for operating, Shafer & King 401,861
Cigar bunching machine, J. E. Smith 402,068, 402,039
Clasp, P. Frantzen 401,890
Clasp, O. C. Mann 401,844
Clasp, F. B. Spooner 401,977
Clutch, L. Goddu 402,014
Coffee or tea pot, G. W. Adams 401,919
Coffin fastener, C. E. Temple 401,767
Comb. See Curry comb.
Computating device, D. W. Thompson 401,801
Condenser switch board, W. Marshall 402,027
Convertible suspending chair, M. E. Schutt 402,110
Copying apparatus, G. H. Smith 401,762
Coupling. See Car coupling. Pipe or tube coupling. Thill coupling.
Crank for motors, S. F. Armstrong 402,052
Cultivator, J. Dodge 401,778
Cup. See Dental impression cup.
Curry comb, O. Smith 401,864
Cutlery, table, F. C. Feicker 401,739
Dampening machine, Wendell & Wiles 401,770
Dental impression cup, J. Scheffler 401,792
Desk box, A. W. Phillips 401,757
Desk fastening, school, J. B. Sherwood 402,037
Detergent, F. C. Taylor 401,766
Die. See Gripping die. Thread cutting die.
Diffusion apparatus, F. Bianchi 402,056
Display box, H. D. & F. A. Smith 401,974
Dredging machine, hydraulic, J. McFarlane 401,896
Drenching bit, C. W. Crannell 402,068
Drill. See Ratchet drill.
Earring lobe, Doran & Hall 402,071
Electric cables, splice box for, T. J. Dewees 402,007
Electric conductor, T. Egleston 401,936
Electric machine, dynamo, C. Coerper 402,066
Electric meter, E. Thomson 401,803
Electric motor for tramway vehicles, W. D. Sandwell 401,970
Electric motor trolley switch, W. Christy 402,064
Electric wires, box for the distribution of, D. Brooks, Jr 401,927
Electrotypes, matrix plate for curved, Benedict & Furlong 401,729
Elevator belt shifter, E. W. Houser 401,951
Emery wheels, instrument for cutting or grinding, W. Diebel 401,823
End gate, A. H. Stark 402,111
Engine. See Rotary engine.
Engine, J. Jonson 402,086
Excavators, loading and unloading mechanism for sewer, N. E. Green 402,016
Extractor. See Stump extractor.
Fabrics, machine for tentering and drying, F. Craven 401,932
Faucet, automatically closing, E. E. Furney 402,075
Faucet, basin, B. Johnson 401,952
File, newspaper, T. Lomas 402,024
Filtering apparatus, R. Cooper *et al* 401,980
Finger ring, M. Freed 402,011
Fire escape, I. H. Athey 402,053
Fireproof plaster cloth for ceilings and walls, A. J. Paris 401,967
Fishing reel, G. Paddock 401,849
Flooring jack, Townsend & Winslow 401,868
Fork. See Hay fork.
Fracture apparatus, W. H. De Camp 401,933
Furnace grate, W. H. Lahman 401,955
Furnace joint, sectional, E. Gurney 401,827
Galvanic battery, R. J. Pratt 402,104
Game board, S. T. F. Sterick 402,112
Garment hanger, W. Gowen 401,943
Garment pattern, combination, M. Tuch 402,046
Gas incandescent, L. Paget 401,899
Gas incandescents, making, L. Paget 401,898
Gate. See End gate. Railway gate. Water gate.
Gearing, M. E. Benedict 401,993
Gears, machine for cutting, J. S. Waterman 401,987
Glass building block, G. Falconnier 402,073
Glassware, manufacture of, G. W. Leighton 402,090
Governor for engines, hydraulic, W. H. & J. D. Gray 402,015
Grain separator, S. Freeman 402,012
Grinding and sharpening machinery, H. Buckingham 401,875
Grinding mill, J. B. Alltree 401,872
Gripping die, W. Taylor 401,912
Halter, E. Barnard 401,922
Handle, J. B. Hartman 401,832
Hanger. See Garment hanger.
Harness, A. Schunck 401,973
Harrow and cultivator, disk, E. C. Boyer 401,994
Harrow, disk, R. W. Hardie 401,745
Harrow, spring tooth, Hench & Dromgold 402,079
Harrow, spring tooth, E. W. Herendeen 401,843
Harrow, spring toothed, T. R. Crane 402,000
Harvester, S. D. Maddin 402,025
Harvester binder, H. E. Pridmore 401,901
Harvester, corn, W. D. Steele 402,040
Hat moulding machine, T. P. Wilkinson 401,809
Hay and grain rack, G. Carr 401,733
Hay fork, N. F. Mathewson 402,093
Head rest, chin support, and eye closer for corpses, combined, F. Moharter 402,095
Heater. See Car heater.
Heating apparatus, E. N. Gates 401,940
Heating apparatus, automatic heat regulator for hot water, E. N. Gates 402,076
Hides or skins, machinery for shaving or dressing green, J. Rood 401,905
Hinge, spring, Spruce & Comstock 401,978
Hoisting machine, T. W. Lemieux 401,841
Holder. See Caramel holder. Paper bag holder. Shade holder. Tooth holder.
Hoof shears, J. P. Lee 401,892
Hook. See Button hook. Ladder hook.
Horse boot, J. J. Ryan 402,109
Horse detacher, W. M. Morrison 402,097
Hydrant, A. J. Tyler 402,115
Injector, Lombard & Connor 401,753
Insect powder duster, C. B. Glover 401,941
Insecticide, M. B. Church 401,928
Iron and steel, manufacturing, J. Reese 401,903
Ironing board, A. T. Scanland 401,858
Ironing tabble, J. A. Kimball 401,786
Jack. See Flooring jack. Lifting jack.
Jewelry, plating stock for, J. S. Palmer 401,900
Joint. See Furnace joint. Pipe joint.
Journal bearing, W. E. Elliott 402,009
Key. See Pulley key.
Kitchen cabinet and flour chest, Stone & Colman 402,113
Knitting machine, circular, Pepper & Davis 401,791
Knockdown case for eggs, etc., W. M. Baker 401,873
Ladder hook, J. B. Foote 401,742
Lamps or lanterns, globe or shade for, P. R. D. D'Humy 401,934
Lawn rake, J. B. Detweiler 401,822
Level, spirit, Lewis & Armstrong 401,843
Lifting jack, A. J. Souders 401,865
Light fixture, extension, G. W. Bayley 401,925
Liquids under pressure, reservoir for holding, W. H. Thayer 401,980
Lock. See Nut lock.
Loom, H. Wyman 402,122
Loom shedding mechanism, C. Hahlo *et al* 401,947
Loom stop mechanism, Crompton & Wyman 402,091
Mandrels, keys, etc., machine for driving, Richards & Walker 401,968
Manure distributer, J. A. Tigner 401,768
Mechanical movement, J. Hunt 402,018
Mechanical movement, F. H. Richards 401,904
Message and time recorder, J. C. Wilson 402,120
Metal can, box, or other receptacle, G. A. Waeber 401,913
Metal strips for ornamental metal lattice or fence work, machine for shaping, F. H. Kindl 402,087
Metallic mould, N. Washburn 401,804
Meter. See Electric meter. Power meter.
Milk can, A. W. H. Smith 401,863
Mill. See Grinding mill. Ore grinding mill.
Mould. See Metallic mould.
Motor. See Electric motor. Railway motor. Water motor.
Motor, W. H. Patton 401,756
Motor and electric generator, combined, J. F. Shawhan 401,761
Mower, P. C. Close 401,817
Musical instruments, arm rest for, J. Bohmann 401,814
Nut lock, J. L. Bay 402,054
Nut lock, I. F. Leiby 402,023
Oar, bow facing, S. R. Sweet 402,114
Ore concentrator, W. H. Meginness 402,094
Ore grinding mill, J. McKenzie 401,964
Oven and flatiron heater, S. E. Robinson 401,969
Packing, rod, S. Udstad 401,984
Paper bag holder, H. E. Gage 401,825
Paper making machinery, S. Wilmot 401,917
Paper reel, H. T. Wilson 402,050
Paper weight, F. B. Whipple 402,048
Passenger register, A. Romain 402,035
Pavement for streets or roads, M. Levi 401,752
Pen, fountain, W. Van Demark 401,985
Petroleum burner, C. V. Fleetwood 401,741
Phonographs or telephones, mouthpiece guard for, W. L. Candee 401,732
Photographic camera, E. Hackh 401,946
Photographic cameras, attachment for, G. D. Thompson 401,802
Photographic plates with emulsion, apparatus for coating, R. E. M. Bain 401,771
Pin. See Safety pin.
Pipe joint, F. A. Lane 402,089
Pipe moulding apparatus, former for, McNeal & Stineruck 402,029
Pipe or tube coupling, G. W. H. Brogden 401,996
Pipe wrench, L. J. Bergendahl 401,926
Pitman, P. R. Pulliam 402,105
Planter, corn or cotton, Armstrong & Lowrey 401,728
Planter, seed, J. Mitchell 401,897
Plow attachment, gang, E. H. Farmer 401,937
Plow, ditching, W. Burton 401,998
Plug for sinks, tubs, etc., W. B. Smith 401,976
Pot. See Coffee or tea pot.
Poultry carrier, G. M. Besrbower 401,812
Power meter, Clark & Low 401,929
Press. See Printing press.
Pressure contact arm, universal upward, C. J. Van Depoele 402,117
Printing machine, J. W. Osborne 401,790
Printing press, hand, J. Kunze 401,839
Printing presses, paper folding attachment for, T. C. Dexter 401,737
Propeller, screw, A. Vogelsang (r) 10,997
Protector. See Check protector. Scarf protector.
Pulley key, C. W. Clark 402,065
Pulverizer, rotary, M. B. Dodge 401,578
Pulverizing clay and extracting stone, machine for, J. W. Shaffer 401,862
Pump, G. W. Stafford 401,979
Pump brake, A. J. Tyler 402,116
Pump bucket, C. La Dow 401,954
Pumps, valve gear for duplex steam, N. E. Nash 402,100
Punch, W. H. Woglom 401,918
Punching, shearing, and such like machine, C. Schumacher *et al* 401,795
Puzzle, F. Howard 402,017
Quilting machine shuttle carrier, Thomas & Creter 401,981
Rack. See Hay and grain rack. Umbrella or cane rack.
Rail brake, M. A. Michales 401,755
Railway bridges, danger signal for, J. W. Steele, 401,763, 401,764, 401,799, 401,800
Railway gate, A. J. McDonald 401,754
Railway, incline electric, R. M. Hunter 402,084
Railway motor, street, B. C. Pole 401,855
Railway rail, E. J. Knapp 402,022
Railway signal and switch connections, compensator for, Mitchell & Stevens 402,030
Railway system, electric, S. H. Short 401,796
Railway tie, metallic, A. J. Hartford 401,949
Railways, sheaf supporting frame for cable, J. Walker 401,986
Railways, system of elevated conductors for electric, S. H. Short 401,797
Rake. See Lawn rake.
Rammer, steam road, F. W. Carter 402,063
Ratchet drill, W. G. Morgan 402,096
Razor strop, flexible, J. L. Pomeroy 402,033
Recorder. See message and time recorder.
Reed chair, etc., J. Lemman 401,959
Reed or rattan chair, etc., H. T. Leavis 401,958
Reel. See Fishing reel. Paper reel.
Reel for machines for forming and reeling ropes or strands, M. H. Day 402,044
Register. See Passenger register.
Ring. See Ear ring. Finger ring.
Rivet, A. Kirks 401,747
Riveting, hydraulic machine for, H. Smith 401,975
Roller mill feeder, R. Wilcox 402,049
Rotary engine, M. A. Buford 401,816
Rotary engine, J. F. Hines, Sr 401,835
Ruling machine, paper, H. A. Brissard 402,057
Saddle trees, forming flexible, J. M. Fink 401,938
Safety pin, J. Alcock 402,051
Sash fastener, Trost & Weston 402,074
Sawmill carriages, offset mechanism for, W. Gowen 401,942
Sawmill carriages, offsetting device for, W. Gowen 401,944, 401,945

© 1889 SCIENTIFIC AMERICAN, INC.

Sawmill set works, W. A. Campbell 401,876
Saw set, F. C. Feicker 401,740
Saw set, E. H. Ketchum 401,785
Saws, table top for circular, I. G. Marston 401,894
Sawing machine, tree, J. C. Schulte 402,036
Scarf protector, J. H. Moyer 402,031
Scraper, A. Stewart 401,911
Scraper, wheeled, C. H. Sawyer 401,907
Scroll and resawing machine, combined, F. H. Crafts 402,067
Secondary battery, C. Desmazures 402,006
Secondary battery, W. W. Griscom 401,744
Secondary battery, W. P. Kookogey 401,953
Seesaw, F. Spencer 401,796
Self-waiting table, A. Dahlstrom 401,820
Separator. See Grain separator.
Sewing, A. Ortmayer 401,966
Sewing machine, J. W. Dewees 401,776
Sewing machine, G. A. & J. G. Xander 401,989
Shade holder, G. E. Somers 409,910
Shaft crank, C. Fosdick 402,010
Shaft, flexible, T. Gare 401,881
Sheaf carrier, H. E. Pridmore 401,902
Shears. See Animal shears. Hoof shears.
Shoe fastening, Whittier & Herron 401,808
Shoe or slipper, J. Hanan, Jr 401,830
Show and shot case, combined, W. A. Whitmore 402,119
Shutter, S. L. & E. M. Bloom 401,813
Shutter fastener, C. J. Seymour 401,860
Sifter, ash, G. M. Peirce 401,852
Signal. See Switch signal.
Sled, V. D. Johnson 402,019
Smoke consumer, C. McGinniss 401,846
Soldering tin cans, machine for, W. Hipperling 401,887
Spinning bobbin, etc., L. C. Baldwin (r) 10,996
Spinning spindle support, F. H. Wheat 401,988
Spool blanks, machine for forming, C. A. Broughton 401,997
Spring. See Vehicle spring.
Stalks, apparatus for removing end sections from, H. A Hughes 402,081
Stamps, device for protecting postage, H. R. McCalmont 401,961
Stand. See Bottle stand.
Stave jointing machine, A. M. Benson 401,874
Steam boiler, L. W. & N. Lombard 402,091
Steam trap, C. F. Brigham 401,772
Stereoscope, H. C. White 401,807
Stereotype plates, matrix for, G. Eastwood 401,738
Stopper. See Bottle stopper.
Stove, R. H. Gohmann 402,123
Stove, J. H. Keyser 401,889
Stove, single cylinder, J. H. Keyser 401,888
Stoves, burner for gas, L. Kahn 401,783
Stoves, oil burner for, H. Schreiner 401,793
Stump extractor, Paris & Dilday 401,850
Sugar from sorghum by diffusion, extracting, H. A. Hughes 402,083
Sugar production from sorghum, H. A. Hughes 402,082
Sulphate of silver, preparing, F. Gutzkow 401,828
Suppository machine, W. J. Hull 401,838
Surgical applicator, E. Lee 401,787
Surveyor's corner stake, J. H. Howlett 401,782
Suspension device, W. C. Homan 401,781
Swaging device, J. Taylor 402,045
Sweat pad fastener, L. H. Scruggs 401,859
Switch. See Electric motor trolley switch.
Switch signal, K. H. Wade 401,869
Syringe, hypodermic, H. Haussmann 401,950
Table. See Ironing table. Self-waiting table.
Tack strips, machine for making, M. Brock, 402,058, 402,060 to 402,062
Tack strips, machine for making J. A. Crosbie 402,069
Tack strips, machine for setting, M. Brock 402,059
Telegraph system, printing, C. J. A. Munier 402,099
Telephone, E. A. Woelk 402,121
Telephone transmitter, W. Gillett 401,743
Tellurian, L. Deichmann 402,005
Temple for guiding the edges of fabrics, J. J. Schofield 401,972
Thill coupling, F. Gandy 401,826
Thill coupling, J. A. Hinson 401,885
Thrashing machine, F. F. Landis 401,840
Thread cutting die, J. E. McCanna 401,962
Tie. See Railway tie.
Tobacco cutting machine, W. Krutzsch 402,088
Toboggan, G. H. Chadeayne 401,734
Tongs, roofing, R. B. McConnell 401,965
Tool, combination, S. L. Heinold 401,821
Tooth holder, J. W. Harris 401,853
Torch, H. Wellington 401,805
Torpedo, staff, H. P. Young 401,810
Torpedoes, net cutting attachment for, S. A. Brown 401,773
Trap. See Steam trap.
Trestle, folding, J. T. Miller 401,848
Truss, A. Dallas 401,877
Tug, hame, L. Latil 401,957
Type writer case, H. D. Pursell 402,106
Type writing machine, L. G. Garrett 401,780
Type writing machine, G. W. N. Yost 401,990
Type writing machines, inking ribbon spool for, H. Ray 401,856
Umbrella or cane rack, W. Gable 402,013
Valve, cut-off, J. J. Tonkin 401,963
Valve, engineer's brake, Westinghouse & Moore 401,916
Valve for reducing and regulating pressure of fluids, W. P. & R. P. Thompson 401,982
Valve gear, E. B. Benham 401,730
Valve gear, cut-off, A. L. Harrison 401,831
Valve, relief, F. T. Mueller 402,098
Valve, safety, W. F. Cunningham 402,070
Valve, steam engine, G. A. Barth 401,924
Valve, steam engine, W. S. Phelps 401,853
Valve, straight-way, W. T. Kellogg 401,784
Vehicle body, L. A. Melburn 401,847
Vehicle brake, J. W. Martin 401,960
Vehicle spring, A. E. Cook 401,818
Vehicle step, folding, M. M. Marsh 401,845
Vehicle, two-wheeled, S. L. Kinsey 402,020
Vehicle wheel, J. Nipp, Jr 401,965
Velocipede, marine, S. Curlin 401,736
Vending apparatus, W. Lang 401,891
Vending machine, G. J. Dollinger 402,008
Ventilator. See Car ventilator.
Violin tail piece fastener, M. W. White 402,118
Wagon, dumping, L. Rodenhausen 402,034
Wash boiler, W. W. Ford 401,879
Washing machine, H. Broadwell 401,731
Washing machine, W. S. Laney 401,956
Washing machine, J. Stine 402,041
Washing machine, T. Waldron 401,769
Watch balance, compensation, A. F. Pickert 402,032
Watchmaker's staking tool, J. C. Rocheleau 401,759
Watch, stem winding and setting, C. Bohnenstiel. 401,815
Water conductor support, J. Davis 402,003
Water gate, W. T. McCloskey 401,788
Water motor, A. A. Besemer 402,055
Water wheel, F. Le Beau 401,751
Welding together sections of pipe by electricity, E. E. Ries 402,107, 402,108
Wheel. See Vehicle wheel. Water wheel.
Windlass for clothes lines, H. Fuchs 401,824
Windmill, G. P. Thurston 401,867
Wood, apparatus for grinding, F. H. Schmidt 401,971
Wrench. See Pipe wrench.
Wrench, S. Cook 401,819

TRADE MARKS.

Antiseptic powder, N. A. & C. G. Lloyd 16,518
Anti-sudorific powder, N. Khasan 16,514
Cigars, cigarettes, and cheroots, L. Kahner & Co 16,513
Corsets, H. C. F. Koch & Co 16,515
Cotton fabrics, bleached, colored, and printed, Miller, Kaster & Co 16,519
Fertilizers, bone, H. S. Miller & Co 16,520
Garments, outer, F. F. Tebbetts 16,528
Hair restorative, J. Falke 16,510
Harness and horse blankets, J. N. Van Ness & Co 16,530
Hay elevators or carriers, M. G. Grosscup 16,511
Knitted shirts, drawers, overshirts, blouses, and jackets, S. Conde 16,505
Liquors, alcoholic, H. & G. Rab 16,523
Medicinal lotion, T. Angelo 16,503
Oil, petroleum lubricating, Vacuum Oil Company 16,529
Oranges, lemons, and products of the citrus family, H. S. Sanford 16,525
Perfumery, Ladd & Coffin 16,516
Perfumes, perfumed waters, and bay rum, also soaps, powders, and cosmetics, J. Wanamaker 16,531
Pipes, cigar and cigarette holders, and cigarette paper, Quentin & Co 16,522
Roofing, impregnated canvas, linen, and cloth for, F. Reddaway & Co 16,524
Rubbing stones for cleaning and polishing, Murphy & Mosier 16,521
Seeds, timothy, Conklin & Mersereau 16,506
Shirtings, sheetings, ginghams, tickings, cheviots, and prints, Lewis Bros. & Co 16,517
Sirups and rock candy, Dryden & Palmer 16,509
Soap, laundry and toilet, Schultz & Co 16,527
Tonic beverage, aerated, Schmidt & Starbird 16,526
Whisky, Belmont Distillery Company 16,504
Whisky, J. Cornibe 16,507
Whips, H. S. Cushman 16,508

DESIGNS.

Ax, W. C. Kelly 19,056
Bretzel or cracker, E. H. Sandt 19,059
Brick, building, W. H. Fish 19,055
Glassware, ornamentation of, W. C. Anderson 19,053
Glass, window, W. Buttler 19,054
Knitted fabric, G. D. Kinsey 19,057, 19,058
Strength tester casing, G. Soeding 19,060

A printed copy of the specification and drawing of any patent in the foregoing list will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

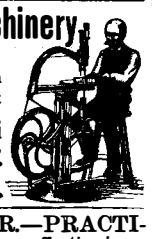
USE ADAMANT WALL PLASTER

It is **Hard, Dense, and Adhesive.** Does not *check or crack.* It is impervious to wind, water, and disease germs. It dries in a few hours. It can be applied in any kind of weather. It is in general use. Licenses granted for the mixing, using, and selling. Address

ADAMANT MFG. CO.
71 E. Genesee Street, Syracuse, N. Y.

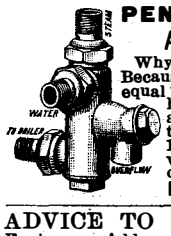
TRANS-CASPIAN RAILWAY TO Samarkand.—General description of the great Central Asian Railway, constructed by Russia to open the interior of Turkestan and Bokhara to her commerce. With five illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **668.** Price 10 cents. To be had at this office and from all newsdealers.

Patent Foot Power Machinery.
Complete Outfits.



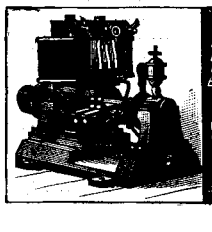
Wood or Metal workers without steam power, can successfully compete with the large shops, by using our New **LABOR SAVING Machinery,** latest and most improved for practical shop use, also for Industrial Schools, Home Training, etc. Catalogue free.
Seneca Falls Mfg. Co.
695 Water Street, Seneca Falls, N. Y.

HOME-MADE INCUBATOR.—PRACTICAL directions for the manufacture of an effective incubator that has been carefully tested and found to perform all that may be reasonably expected; with directions for operating. With 4 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **630.** Price 10 cents. To be had at this office and from all newsdealers.



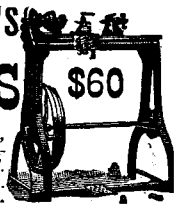
PENBERTHY IMPROVED AUTOMATIC INJECTOR.
Why 20,000 have been sold in two years. Because they cost less than others and do equal work. Lift 20 feet and work from head as well. Re-start themselves and require no watching. Will lift through hot pipes, work from 25 to 150 lbs. pressure. Parts removable without disconnecting, also interchangeable. Send for pamphlet.
Penberthy Injector Co., Detroit, Mich.

ADVICE TO YOUNG MECHANICAL Engineers.—Address by Prof. Perry, to his students at the Finsbury Technical College. A paper of great value and interest to all working engineers. With one engraving. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **661.** Price 10 cents. To be had at this office and from all newsdealers.



C&C ELECTRIC MOTORS
FROM 1/2 HORSE POWER UP, FOR DRIVING LATHES, PLANING MACHINES, FANS, SEWING MACHINES, PUMPS, ELEVATORS, PRINTING PRESSES ETC.
THESE MOTORS ARE ELECTRICALLY EFFICIENT FOR MARCH OR INCANDESCENT LIGHT CIRCUITS OR STORAGE BATTERIES.
THE C&C ELECTRIC MOTOR CO

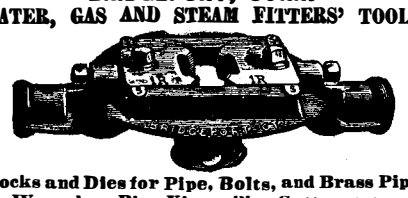
SEBASTIAN, MAY & CO'S
Improved Screw Cutting
Foot & Power **LATHES**



Drill Presses, Chucks, Drills, Dogs, and machinists' and amateurs' outfits. *Lathes on trial.* Catalogues mailed on application.
165 W. 2d St., Cincinnati, O.

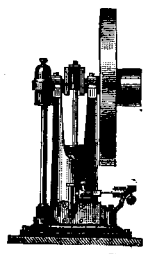
PROPULSION OF SHIPS BY AIR Propellers.—By H. C. Vogt. Description of a novel system of marine propulsion through propellers actuated by the wind. With a detailed statement of experiments and figures of the results obtained. With two illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **670.** Price 10 cents. To be had at this office and from all newsdealers.

THE ARMSTRONG MFG. CO.
BRIDGEPORT, CONN.
WATER, GAS AND STEAM FITTERS' TOOLS.



Stocks and Dies for Pipe, Bolts, and Brass Pipe, Wrenches, Pipe Vises, Pipe Cutters, etc.
Catalogues sent free on application.

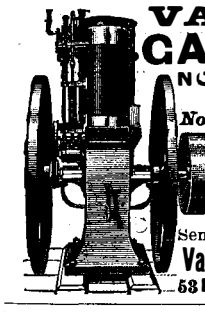
WAR SHIPS OF THE FUTURE.—AN elaborate discussion of the features that are possibly to characterize the war ship of the future. With 8 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **670.** Price 10 cents. To be had at this office and from all newsdealers.



OTTO GAS ENGINES.
Over 25,000 Sold.
Horizontal .....Otto....Gas Engines.
Vertical.....Otto....Gas Engines.
Twin Cylinder..Otto....Gas Engines.
Combined.....Otto.. { Gas Engines and Pumps.
Combined.....Otto.. { Gas Engines and Dynamos
OTTO GAS ENGINE WORKS,
CHICAGO, PHILADELPHIA.
New York Agency, 18 Vesey Street.

NOTES ON TECHNICAL EDUCATION.—A paper by Dr. R. H. Thurston, in which the author discusses the reason and purpose of technical education, and its value in the development of the powers of the masses of the people, and the securing of the greatest possible prosperity of the nation. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **668.** Price 10 cents. To be had at this office and from all newsdealers.

STEAM REGULATING SPECIALTIES
Made by us are guaranteed and used by all the car heating companies, railroads, etc.
MASON REGULATOR CO., Boston, Mass.



VAN DUZEN GAS ENGINE
NO BOILER. NO COAL. NO ENGINEER.
No Extra WATER RENT or INSURANCE.
INSTANTLY STARTED.
DURABLE, RELIABLE, SAFE and ECONOMICAL.
Send for description and prices.
Van Duzen Gas Engine CO.,
53 E. 2nd St., CINCINNATI, O.

DISTRIBUTING HEAT AND POWER.—Full description, by E. D. Meier, of the Prall system of distributing heat and power from central stations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **660.** Price 10 cents. To be had at this office and from all newsdealers.

SECTIONAL INSULATED AIR COVERINGS

FOR PIPES, BOILERS, DRUMS, AND ALL OTHER HOT & COLD SURFACES
ASBESTOS, CEMENT, PACKING, SHEATHING &C.
SHIELDS & BROWN CO.
143 WORTH ST. NEW YORK. 240 & 242 RANDOLPH ST. CHICAGO.

WATCH CLEANING AND REPAIRing.—A valuable and practical paper, full of useful suggestions. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **664.** Price 10 cents. To be had at this office and from all newsdealers.

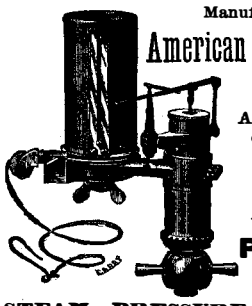
JUST OUT!
ALUMINUM-STEEL HACK SAW.
Frame and 1 doz. blades, $2; Blades per doz., 8-inch, $1, by mail upon receipt of price. Hard but not brittle.
CRESCENT MFG. CO., CLEVELAND, O.
New catalogue of Engineers' Specialties.

MANGANESE STEEL AND ITS PROPerties.—Abstract of two papers on this subject by Mr. Robert A. Hadfield. Assoc. M. Inst. C.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **640.** Price 10 cents. To be had at this office and from all newsdealers.

BARREL, KEG, Hogshead, AND STAVE MACHINERY.
Over 50 varieties manufactured by
Truss Hoop Driving. E. & B. Holmes, BUFFALO, N. Y.

USEFUL BOOKS.
Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has recently been published for free circulation at the office of this paper. Subjects classified with names of author. Persons desiring a copy, have only to ask for it, and it will be mailed to them. Address,
MUNN & CO., 361 Broadway, New York.

THOMPSON IMPROVED INDICATOR
Manufactured solely by
American Steam Gauge Co.
2,000 IN USE.



Adopted by the U. S. Navy on all the government cruisers and gunboats to be built.
Also Manufacturers of
POP SAFETY VALVES,
STEAM PRESSURE GAUGES, ETC.
34 Chardon Street, Boston, Mass.

REDUCING ACTION OF HYDROgen.—By Stephen Cooke. An interesting chemical investigation made with a view to ascertaining the effect of the presence of platinum on the reducing action of hydrogen. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **668.** Price 10 cents. To be had at this office and from all newsdealers.

WATCHMAKERS
Send to **American Watch Tool Co.,** Waltham, Mass., for price list of Whitcomb Lathes and for the new Webster-Whitcomb.

THE CRANK'S STORY.—BY G. H. Edwards, C.E. The part played by the crank in developing the economy of steam in multiple cylinder engines. With two figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641.** Price 10 cents. To be had at this office and from all newsdealers.

NICKEL PLATING
& POLISHING MATERIALS.
ZUCKER & LEVETT
CHEMICAL Co. NEW YORK U.S.A.

NICKEL ANODES,
NICKEL SALTS,
ROUGES,
COMPOSITION,
BUFFING WHEELS,
ELECTRO & NICKEL PLATING OUTFITS.

TO BUSINESS MEN.
The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done, for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.
For rates see top of first column of this page, or address
MUNN & CO., Publishers, 361 Broadway, New York.

OIL WELL SUPPLY CO. Ltd.
91 & 92 WATER STREET, Pittsburgh, Pa.,
Manufacturers of everything needed for
ARTESIAN WELLS
for either Gas, Oil, Water, or Mineral Tests, Boilers, Engines, Pipe, Cordage, Drilling Tools, etc.
Illustrated catalogue, price lists and discount sheets on request.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **59.** Price 10 cents. To be had at this office and of all newsdealers.

ARTESIAN
Wells, Oil and Gas Wells, drilled by contract to any depth, from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send 6 cents for illustrated catalogue. **Pierce Artesian and Oil Well Supply Co.,** 80 Beaver Street, New York.

WATER OF CONDENSATION.—A DEscription of the various apparatus that have been devised for the extraction of water of condensation from the steam-heated apparatus used in the industries. With 24 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **659.** Price 10 cents. To be had at this office, and from all newsdealers.

PHOTOGRAPHS.
The photographing of Machinery, Bridges, Factories, and Iron Work of all descriptions. Write for samples
GEO. P. HALL & SON, 157 Fulton Street, New York.

Stored Energy
ACCUMULATORS for Electric Lighting and Street Car Propulsion.
ELECTRICAL ACCUMULATOR COMPANY,
No. 44 Broadway, New York City.

Edco System.
Complete Electric Light and Power Plants. Street Cars equipped for Electric Propulsion. The oldest and most experienced Electric Motor Co. in the world.
THE ELECTRO DYNAMIC COMPANY,
No. 224 Carter St., Philadelphia, Pa.

© 1889 SCIENTIFIC AMERICAN, INC.

FRESH AND VALUABLE

TECHNICAL BOOKS

BRANNT.—The Metallic Alloys. A Practical Guide for the Manufacture of all kinds of Alloys, Amalgams, and Solders used by Metal Workers; together with their Chemical and Physical Properties and their Application in the Arts and the Industries; with an Appendix on the Coloring of Alloys. Translated and edited, chiefly from the German of A. Krupp and Andreas Wildberger, with extensive additions, by Wm. T. Brannt, one of the editors of "The Techno-Chemical Receipt Book," etc. Illustrated by 16 engravings. 12mo, 428 pages.....**$2.50**

☞ *A descriptive circular giving the full contents of the above sent free to any one who will apply.*

EDWARDS.—The American Steam Engineer, Theoretical and Practical. With examples of the latest and most Approved American Practice in the Design and Construction of Steam Engines and Boilers of every description. For the use of Engineers, Machinists, Boiler Makers, and Students. By Emory Edwards, M.E. Illustrated by 77 engravings. In one volume, 12mo....**$2.50**

☞ *An illustrated circular of this book, 4 pages, 4to, sent free to any address.*

BRANNT.—A Practical Treatise on Animal and Vegetable Fats and Oils, comprising both Fixed and Volatile Oils, etc., as well as the Manufacture of Artificial Butter, Lubricants, including Mineral Lubricating Oils, etc., and on Ozoker te, etc. By Wm. T. Brannt. 244 engravings. 730 pages, 8vo.....**$7.50**

☞ *An illustrated circular, 8 pages, quarto, showing the full table of contents of this book, sent free of postage to any one addressing us.*

BRANNT.—A Practical Treatise on the Manufacture of Soap and Candles, based upon the most recent Experiences in the Science and Practice. By Wm. T. Brannt. Illustrated by 163 engravings. 677 pages. 8vo.....**$7.50**

☞ *An illustrated circular, 8 pages, 4to, showing contents of this book, will be sent free of postage to any one furnishing his address.*

BRANNT-WAHL.—The Techno-Chemical Receipt Book. Containing Several Thousand Receipts, covering the Latest, most Important, and most Useful Discoveries in Chemical Technology, and their Practical Application in the Arts and the Industries. By W. T. Brannt and W. H. Wahl, Ph.D. 78 engravings, over 500 pages. **$2.00**

☞ *A circular showing full contents of this book, 32 pages, sent free on application.*

OSBORN.—Practical Manual of Minerals, Mines, and Mining. By Prof. H. S. Osborn, LL.D. Illustrated by 171 engravings from original drawings. 367 pages, 8vo. **$4.50**

ROSE.—Steam Boilers. A Practical Treatise on Boiler Construction and Examination. For the use of Practical Boiler Makers, Boiler Users, and Inspectors; and embracing in plain figures all the Calculations necessary in Designing and Classifying Steam Boilers. By Joshua Rose. Illustrated. 8vo.....**$2.50**

SLOANE.—Home Experiments in Science. By T. O'Conor Sloane, E.M., A.M., Ph.D. Illustrated by 91 engravings. 12mo.....**$1.50**

☞ *Illustrated circulars, each 4 pages 4to, showing the full table of contents of the last three named books, sent free on application.*

☞ *The above or any of our Books sent by mail, free of postage, at the publication prices, to any address in the world.*

☞ *Our New and Revised Catalogue of Practical and Scientific Books, 84 pages, 8vo, and our other Catalogues, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Philadelphia, Pa., U. S. A.

GWILT'S ENCYCLOPÆDIA
—OF—
ARCHITECTURE

Historical, Theoretical, and Practical.

With about 1,700 illustrations. **New Edition.** Revised and with additions (1888). 1,460 pages. Cloth.....**$17.50**

Mitchell's Stepping-Stone to Architecture.

22 plates and 50 figures. Foolscap 8vo.....**50 cents**

The Testing of Materials of Construction.

A text book for the Engineering Laboratory, and a collection of the results of experiments. By W. Cawthorne Unwin, M.I.C.E. Numerous illustrations. 8vo, cloth.....**$7.00**

TEXT BOOKS OF SCIENCE. A series of Elementary works on Science. 26 volumes.
☞ Full list on application.

LONGMANS, GREEN & CO.,
15 East 16th Street, New York.

ARCHITECTURAL BOOKS.

Useful, Beautiful, and Cheap.

To any person about to erect a dwelling house or stable, either in the country or city, or any builder wishing to examine the latest and best plans for a church, school house, club house, or any other public building of high or low cost, should procure a complete set of the ARCHITECTS' AND BUILDERS' EDITION of the SCIENTIFIC AMERICAN.

The information these volumes contain renders the work almost indispensable to the architect and builder, and to persons about to build for themselves they will find the work suggestive and most useful. They contain colored plates of the elevation, plan, and detail drawings of almost every class of building, with specification and approximate cost.

Four bound volumes are now ready and may be obtained, by mail, direct from the publishers or from any newsdealer. Price, $2.00 a volume. Stitched in paper covers. Subscription price, per annum, $2.50. Address and remit to

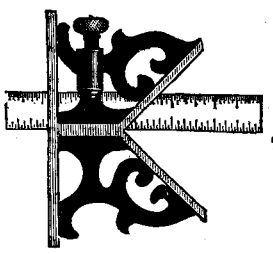
MUNN & CO., Publishers,
361 Broadway, New York.

PERFECT NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, Magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper. Address

MUNN & CO., Publishers SCIENTIFIC AMERICAN.

CURE for the DEAF by PECK'S PAT. IMPROVED CUSHIONED EAR DRUMS. Whispers heard distinctly. Comfortable, invisible. Illustrated book & proofs, **FREE**. Address or call on F. HISCOX, **853** Broadway, N. Y. Name this paper.



STANDARD TOOL CO.

ATHOL, MASS.

MANUFACTURERS OF

The Celebrated Chaplin Try and Center Squa e, Standard Steel Rules, Steel Caliper Rules, Universal Bevels, Caliper Gauges, Improved Surface Gauges, Bevel Protractors, Depth Gauges, Screw Pitch and Center Gauges, Hardened Steel Squares, Graduated Steel Squa es, Spring Calipe s, Pliers, St aight Edges, etc., etc.

WRITE FOR ILLUSTRATED CATALOGUE AND PRICE LIST OF FULL LINE.

THE GREAT TELESCOPES OF THE World.—A paper by Prof. John K. Rees, giving a popular account of all the great telescopes, their powers and limitations and method of construction. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **635**. Price 10 cents. To be had at this office and from all newsdealers

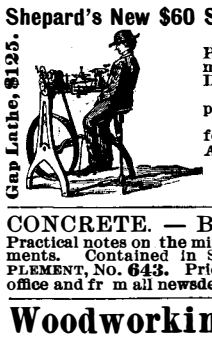
100 Lessons in BUSINESS.

Something Entirely New.

20,000 copies sold in six months. One of the most successful books published in this country. Checks and other business forms reproduced in colors from actual commercial paper. Short cuts in figures from many foreign sources. Beautifully bound. Mailed to any address in the world for **One Dollar.** Valuable circulars free. Address

SEYMOUR EATON,
50 Bromfield Street, BOSTON, MASS.

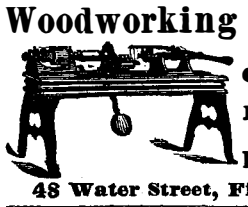
Shepard's New $60 Screw-Cutting Foot Lathe



Foot and Power Lathes, Drill Presses, Scroll Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Lathes on trial. Lathes on payment.
Send for catalogue of Outfits for Amateurs or Artisans.
Address **H. L. SHEPARD, AGENT,**
134 East 2d Street, Cincinnati, Ohio.

CONCRETE. — BY JOHN LANDIS. Practical notes on the mixing and manipulation of cements. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **643**. Price 10 cents. To be had at this office and fr m all newsdealers.

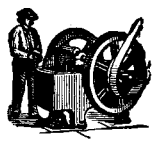
Woodworking Machinery



FOR
Chair, Furniture and Cabinet Mills, Pattern Makers' use etc.
Rollstone Machine Co.,
48 Water Street, Fitchburg, Mass.

DO YOUR OWN PLATING

Either in Gold, Silver, or Nickel, and Electrotyping. Complete sets of each, with practical instruction that any person may learn the art easily. Send for catalogue and price list to THOS. HALL, Mfg. Electrician and Optician, 19 Bromfield Street, Boston, Mass.

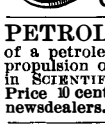


ROCK BREAKERS AND ORE CRUSHERS

We manufacture and supply at short notice and lowest rates, Stone and Ore Crushers, containing the invention described in Letters Patent issued to Eli W. Blake, June 15, 1858, together with NEW AND VALUABLE IMPROVEMENTS, for which Letters Patent were granted May 11th and July 20th, 1880, to Mr. S. L. Marsden. All Crushers supplied by us are constructed under the superintendence of Mr. Marsden, who, for the past twenty years, has been connected with the manufacture of Blake Crushers in this country and England.
FARREL FOUNDRY and MACHINE CO., Manufacturers, ANSONIA, CONN.
COPELAND & BACON, Agents, NEW YORK and PHILADELPHIA.

BIT Square, Oval, or Round Smooth Holes. For Carpenter, Cabinet, and Pattern work, ⅛ inch, 50 cents, set $4.00, mailed free. Bridgeport Gun Implement Co., 17 Maiden Lane, New York.

PETROLEUM FUEL.—AN ACCOUNT of the Pennsylvania Railroad's experiments with the Urquhart system of burning petroleum on locomotives, and also of the experience of the Grazi-Haritzin Railroad with coal oil as a fuel. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **615**. Price ten cents. To be had at this office and from all newsdealers.



Clark's Noiseless Rubber Truck Wheels
Save floors. Anti-Friction Casters.
Rubber Furniture Casters, etc.
Catalogue free.
Geo. P. Clark, Box L, Windsor Locks, Ct.

PETROLEUM BOAT. DESCRIPTION of a petroleum motor devised by Mr. Lenoir for the propulsion of small boats. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **637**. Price 10 cents. To be had at this office and from all newsdealers.

THE PENNA. DIAMOND DRILL & MFG. CO.
BIRDSBORO, PA., Builders of High Class Steam Engines. Diamond Drilling and General Machinery. Flour Mill Rolls Ground and Grooved.

SEAMLESS TUBES.—DESCRIPTION of the various processes of manufacture; with 44 figures illustrative of the apparatus used. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **638**. Price 10 cents. To be had at this office and from all newsdealers.

2nd MACHINERY Lists Sent.
N. Y. Mach'y Depot, Bridge Store 16, Frankfort St., N.Y.

BONANZA to AGENTS SAMPLES FREE both sexes. Write now **GEO. A. SCOTT,** New York City

ROPE TRANSMISSION OF POWER. —Some valuable suggestions to those who would apply rope in place of leather belting for the transmission of power over long distances. With 12 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **638**. Price 10 cents. To be had at this office and from all newsdealers.

AGENTS WANTED ON SALARY. **$75 per month and expenses** paid any active man or woman to sell our goods by sample and live at home. Salary paid promptly and expenses in advance. Full particulars and sample case FREE. We mean just what we say. Address **Standard Silverware Co., Boston, Mass.**

JAMES B. EADS.—AN ACCOUNT OF the life and labors of this eminent engineer. With a portrait. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **592**. Price 10 cents. To be had at this office and from all newsdealers.

Novelty HOT AIR Furnaces

Expose an Immense Heated Surface.

Extract all the Heat from the Gases. Furnish Pure Warm Air in abundance.

Fifteen Years of Test. Universally Satisfactory.

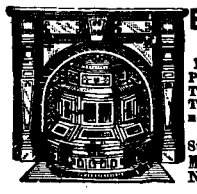
Send for "Our Furnace Book."

Abram Cox Stove Co.,
MANUFACTURERS,
Philadelphia and New York.

PERSONAL IDENTIFICATION AND Description.—By Francis Galton, F.R.S. An interesting paper upon the application of the examination of hand and finger markings to the identification of individuals. With three illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **659**. Price 10 cents. To be had at this office and from all newsdealers.

MOSS ENGRAVING Co 535 PEARL ST NEW YORK
cor Elm St
OUR SPECIALTY: FINE ILLUSTRATED CATALOGUES
BY OUR NEW MOSS-TYPE PROCESS.
Send Green Stamp for Moss-Type Specimens.

ROYAL MICROSCOPIC SOCIETY.—Annual address by the President, Dr. Dallinger, F.R.S., delivered Feb. 8, 1888. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **643**. Price 10 cents. To be had at this office and from all newsdealers.



BIBB'S Celebrated Original
BALTIMORE FIRE-PLACE HEATERS
To warm upper and lower rooms
The Handsomest and Most Economical Coal Stoves in the world.
B. C. BIBB & SON
Stove Founders, Baltimore, Md.
MARBLEIZED SLATE MANTELS
New and Beautiful Designs.

CABINET WOODS and VENEERS,

FRET SAW or BRACKET WOODS,
PLANED READY FOR USE
Send stamp for catalogue.
HENRY T. BARTLETT, 200 LEWIS STREET, NEW YORK.

Barnes' Patent Foot Power Machinery.

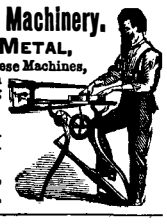
WORKERS OF WOOD OR METAL,

without steam power, by using outfits of these Machines, can bid lower, and save more money from their jobs, than by any other means for doing their work. Also for

Industrial Schools or Home Training.

With them boys can acquire practical journeymen's trades before they "go for themselves." Price-List Catalogue Free.

W. F. & JOHN BARNES CO.,
No. 1999 Ruby St., Rockford, Ill.



DEFEAT OF THE ARMADA IN 1588.—An interesting account of the Invincible Armada collected by Philip II., of Spain, for the subjugation of England, and particulars of the battle which resulted in its defeat. With three engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **660**. Price 10 cents. To be had at this office and from all newsdealers.

ROSE POLYTECHNIC INSTITUTE,
TERRE HAUTE, IND.—A SCHOOL OF ENGINEERING.
Well endowed, well equipped departments of Mechanical and Civil Engineering. Electricity, Chemistry, Drawing. Shops and Laboratories. Expenses low. Address T. C. Mendenhall, Pres.

VOLNEY W. MASON & CO.,
FRICTION PULLEYS CLUTCHES and ELEVATORS
PROVIDENCE, R. I.

MODELS Experimental Work & Light Machinery
N. ERLANDSEN, 107 Rivington Street, N. Y.

ELECTRICAL WELDING.—DESCRIPTION of a method of welding by electricity devised by Mr. N. Von Benardos, of St. Petersburg. With 38 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **635**. Price 10 cents. To be had at this office and from all newsdealers.

CARY & MOEN CO.
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29 ST. NEW YORK CITY

YOUR NAME on THIS NOVELTY 15c
Contains a Pen, Pencil and Rubber Stamp, Postpaid
Flies open by a slight pressure of the thumb. Prints 1, 2 or 3 lines. Highly Nickle Plated. When closed for pocket is size of a common Pencil. New agents make BIG MONEY! Terms FREE with first order. Quickest shipments. Everybody needs one to mark Linen, Cards, Books, etc. Address
Thalman Mfg. Co., No. 112, Baltimore, Md., U.S.A.

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **116**. Price 10 cents. To be had at this office and of all newsdealers.

PULLEYS. Cheapest, Lightest, and Best. Made by Hardwood Split P. Co., Menasha, Wis.

CITY OF TORONTO.

Water Works Department.

Notice is hereby given that the Committee on Water Works of the Municipal Corporation of the City of Toronto is prepared to receive

TENDERS FOR MATERIAL

required for extending the works and increasing the supply as follows:

10,400 feet of 48 inch diameter flexible joint Cast Iron Pipe, or
10,400 feet of 48 inch diameter Steel Plate Pipe with Cast Iron flexible joints, or
4,500 feet of 48 inch diameter flexible joint Cast Iron Pipe, and
6,000 feet of 60 inch diameter Steel Plate Pipe with Cast Iron flexible joints.
Two 48 inch Double Screw Valves.
Two 36 inch Double Screw Valves.
Two 30 inch Double Screw Valves.
Two 24 inch Double Screw Valves.
1,500 feet of 36 inch diameter Cast Iron Spigot and Faucet Pipe.
About 48,000 feet of 12 inch Cast Iron Spigot and Faucet Pipe.
About 46,000 feet of 6 inch Cast Iron Spigot and Faucet Pipe.
Thirty 12 inch Valves.
Thirty 6 inch Valves.
Thirty 4 inch Valves.
Also two Pumping Engines, each of 2½ million imperial gallons capacity per 24 hours, with Boilers, etc., complete, or
Two Pumping Engines, each of 3 million imperial gallons capacity per 24 hours, with Boilers, etc., complete.

Specifications, Forms of Tender, and any further information can be had upon application to the office of the Superintendent of the Department at the address below. Sealed Tenders for the above or any portion thereof, addressed to the undersigned and marked on the outside, "Tender for Pipe," etc., as the case may be, will be received by *Registered Letter* only up to the hour of Two P.M. on Monday, the Third day of June, 1889.

The lowest or any Tender not necessarily accepted.

JAS. B. BOUSTEAD, *Chairman Committee on Water Works.*
WATER WORKS DEPARTMENT,
City Hall, Toronto, Ontario,
12th April, 1889.

Sealed Proposals, in triplicate, will be received at this office until noon, local time, Thursday, May 23, 1889, for furnishing the labor and material required in constructing a Snagboat. Specifications will be furnished bidders on application, and detailed drawings can be examined and all necessary information obtained at this office. Proposals will only be considered from those who can give satisfactory evidence of their ability to construct the boat as required and in the time specified. The United States reserves the right to reject any or all bids. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. D. W. LOCKWOOD, *Major of Engineers, U. S. A.*, U. S. Engineer Office, Custom House, Cincinnati, Ohio, *April* 23, 1889.

THE RICHARDS OIL ENGINE

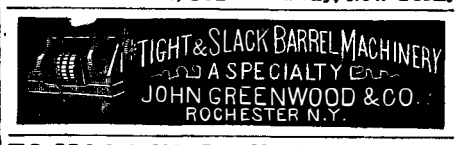
The Safest, Most Economical, and **Most Convenient Engine.** No Boiler, no Steam, no Coal, no Ashes, no Danger, no Extra Insurance, no Engineer, and next to no Attendance. Started instantly with a match. Speed and fuel completely regulated by the governor. All expense ceases when the engine stops. **BINGHAMTON HYDRAULIC POWER CO., Sole Manufacturers, Binghamton, N. Y., U. S. A.**

SERPOLLET'S STEAM GENERATOR. Description of a novel form of generator for the instantaneous production of steam, and free from danger of explosion. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, NO. **664**. Price 10 cents. To be had at this office and from all newsdealers.

MINERAL WOOL **INTERESTING BOOK** Upon Its Uses and peculiar properties, mailed with **sample free**
Western Mineral Wool Co.
CLEVELAND, OHIO.

A NEW CATALOGUE
—OF—
VALUABLE PAPERS

Contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, New York.



TO MACHINE MANUFACTURERS

The subscriber has an article of sterling merit, for which a large market is waiting, and wishes to arrange with parties having capital and desiring to increase their business, or parties who would like to establish a new business, to manufacture and sell. Fully protected by a number of valuable patents. Would take an interest in the business as part payment for the patents, or would sell them outright if desired.
Address W. G., Box 2685, Boston, Mass.

SMELTING and REFINING WORKS COMPLETE, AT RECEIVER'S SALE.

Will be sold on Monday, May 27th, at 1 P. M., at Thomasville, Davidson Co., North Carolina, a completely equipped Smelting and Refinery Works, fitted with the latest and most approved plant of very best quality, in use only a few months. Located in the heart of the mineral region, and drawing from the mines of North and South Carolina, Georgia, Alabama and Tennessee. Also at same time and place, a pole road of 12 miles in length, with equipment, running to the vicinity of numerous developed and working mines. For full information, address RECEIVER, P. O. Box 737, Baltimore, Md.

MACHINE WANTED for upsetting or compressing, by hydraulic or other means, bars of iron or steel for eye-bars having a sectional area of 3 to 10 square inches. Address
"M. G.," care P. Everitt, 243 Broadway, New York.

OPTICIAN.—Wanted as Foreman in our optical factory, a man who thoroughly understands the manufacture of spectacles, glass and focus grinding, etc. QUEEN & CO., 924 Chestnut St., Philadelphia, Pa.

The Scientific American

PUBLICATIONS FOR 1889.

The prices of the different publications in the United States, Canada, and Mexico are as follows:

RATES BY MAIL.

The Scientific American (weekly), one year	$3.00
The Scientific American Supplement (weekly), one year	5.00
The Scientific American, Export Edition (monthly) one year	5.00
The Scientific American, Architects and Builders Edition (monthly), one year	2.50

COMBINED RATES.

The Scientific American and Supplement	$7.00
The Scientific American and Architects and Builders Edition	5.00
The Scientific American, Supplement, and Architects and Builders Edition	9.00

Proportionate Rates for Six Months.

This includes postage, which we pay. Remit by postal or express money order, or draft to order of

MUNN & CO., 361 Broadway, New York.

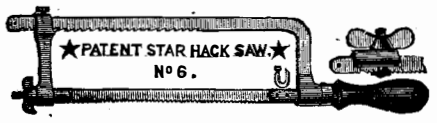
WORKING MODELS & LIGHT MACHINERY INVENTIONS DEVELOPED Send for Model Circular. Jones Bros. E Co., Cin'ti, O.

© 1889 SCIENTIFIC AMERICAN, INC.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.



Both the Frames and Blades of our Star Hack Saws are now as perfect as human skill can make them. The Frame is steel, polished and Nickel plated, and will hold all blades from 3 to 12 inches, and face them in four directions. With the extra clamp, as seen in the cut, all broken Blades can be used. These Saws have a file temper, and one five cent Blade will cut iron or soft steel steadily for several hours, doing more work than a dollar's worth of files.

Price of No. 6 Frame..... $1 00
" " Clamp..... 0 10
" " Blades per doz. 55c 60c 65c 70c 85c 95c $1 05
Inches long.....6 7 8 9 10 11 12

Frame, Blades or Clamp, sent by mail pre paid on receipt of price. Also for sale by all Hardware Dealers. All goods bearing our name are fully warranted.

MILLERS FALLS CO.,
93 Reade Street, New York.

RIDE CYCLES!

VICTORS ARE BEST!

Bicycles, Tricycles, and Safeties.

Send for free illustrated Catalogue.

Overman Wheel Co., Makers,
BOSTON, MASS.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **438.** Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

THE KODAK CAMERA

Makes 100 Instantaneous Pictures by simply pressing a button. Anybody can use it who can wind a watch. No focusing. No tripod. Rapid Rectilinear Lens. Photographs moving objects. Can be used indoors.

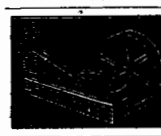
Division of Labor—Operator can finish his own pictures, or send them to the factory to be finished.

Morocco covered Camera, in handsome sole-leather case, loaded for 100 pictures,

For full description of "Kodak" see SCI. AM., Sept. 15, '88.

Price, $25.00. Reloading, $2.00.

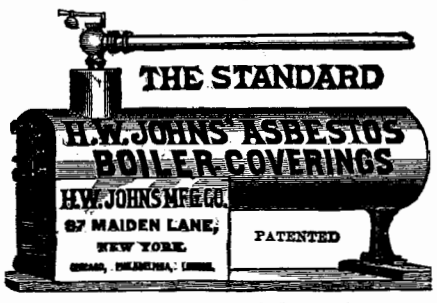
The Eastman Dry Plate & Film Co.
Rochester, N. Y. 115 Oxford St., London.
Send for copy of Kodak Primer with Kodak Photograph.



ERIE ENGINE WORKS
CLEVELAND & HARDWICK,
WALNUT STREET, ERIE, PA.
STATIONARY, PORTABLE, SEMI-PORTABLE COMBINED AGRICULTURAL ENGINES, STATIONARY, PORTABLE VERTICAL BOILERS.

INVENTORS and others desiring new articles manufactured and introduced, address P. O. Box 86, Cleveland, O.

ON VARIABLE LOAD. INTERNAL Friction, and Engine Speed and Work.—By Dr. R. H. Thurston. The result of recent experiments to determine the character of the internal friction of engines, without condensers, and the method of its variation, with the variation of the usual conditions of operation. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **669** and **670**. Price 10 cents each. To be had at this office and from all newsdealers.



THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **632.** Price 10 cents. To be had at this office and from all newsdealers.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS
FINE TINNING JAPANNING AND FINISHING
THOMAS DEVLIN & CO'S
LEHIGH AVE & AMERICAN ST. PHILA

PATENTS.

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty-one years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Patent Building, near 7th Street, Washington, D. C.

THE GUTTA PERCHA & RUBBER MFG. CO.

The Largest Manufacturers of Mechanical Rubber Goods in the World.
ESTABLISHED 1855.
Packing, Belting, Hose, Mats, Matting, etc.
35 WARREN STREET, NEW YORK.
Chicago. San Francisco. Portland, Oregon. Boston, Mass.

CUTLER DESK. BEST IN THE WORLD.

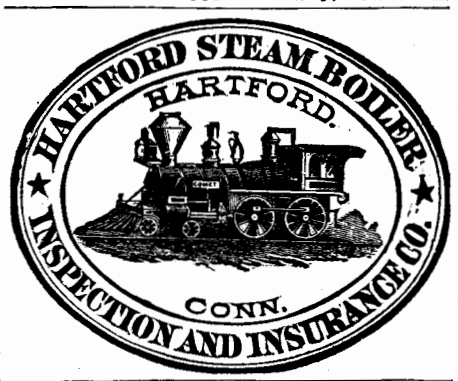
A. CUTLER & SON, BUFFALO, N.Y., U.S.A.

Scientific Book Catalogue

RECENTLY PUBLISHED.

Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.

MUNN & CO., Publishers Scientific American,
361 Broadway, New York.



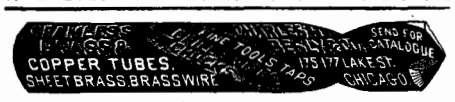
PATENT
JACKET KETTLES,
Plain or Porcelain Lined. Tested to 100 lb. pressure. Send for Lists.
HA ND, BURR & CO.,
614 and 616 Market St., Philadelphia, Pa.

THE EIFFEL TOWER.—AN EXCELlent engraving of the Eiffel one thousand-feet-high tower, which was opened to the public a few days ago, and which is to form a part of the French Exposition attractions, may be found, with description, in the SCIENTIFIC AMERICAN SUPPLEMENT, No. **554.** To be had from newsdealers or at this office. Price 10 cents.

We make a Specialty of
Hard Rubber Pump Valves
For Hot Water, Oils, and Acids, also for very high pressures.
Accept no pump valves as Jenkins or Jenkins Bros., unless stamped like cut.

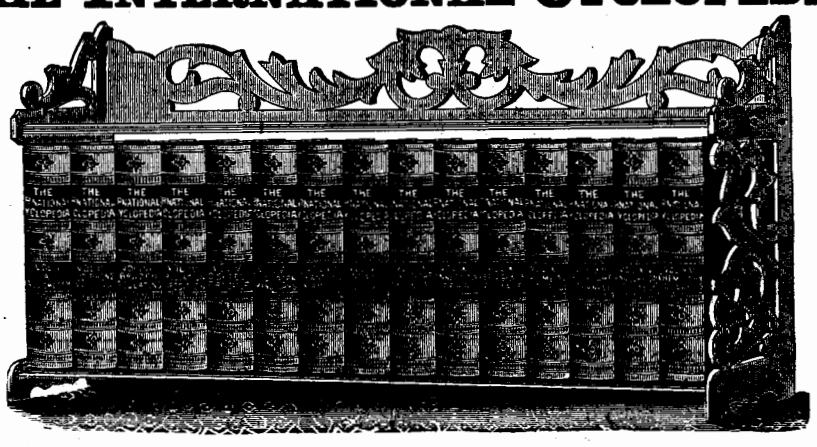
JENKINS BROS. { 71 John Street, New York. 105 Milk Street, Boston. 21 North 5th Street, Phila. 54 Dearborn Street, Chicago.

PARIS EXHIBITION OF 1889.—DEscription of the buildings of the approaching Paris exhibition, and of the grounds which they are to occupy. The Trocadero Park. The Champ de Mars. The Wharves and the Esplanade. Present state of the work. Illustrated with three engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **657.** Price 10 cents. To be had at this office and from all newsdealers.



GRAPHOPHONE AND PHONOGRAPH.—An interesting account of the Edison, Bell, and Tainter apparatus for the mechanical reproduction of speech, with detailed description of the same. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **669.** Price 10 cents. To be had at this office and from all newsdealers.

THE INTERNATIONAL CYCLOPEDIA



"It is up with the times, and is especially full upon American subjects."—*Pres. Seelye, Smith College.*

"When one has the INTERNATIONAL, he does not need any of the others."—*Pres. McMillan, Col. of Montana.*

One of our new agents has just taken twenty-one orders for the "INTERNATIONAL" in his first four weeks' of canvassing.

SALESMEN WANTED.

Sold for Cash or on our **Easy Payment** plan.

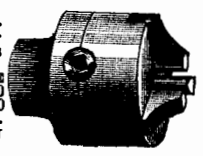
Delivered **free** of expense.

Edition of 1889.
FIFTEEN LARGE ROYAL OCTAVO VOLUMES.
MORE THAN 13,000 PAGES.
MORE THAN 49,000 TOPICS.
150 DOUBLE PAGE ILLUSTRATIONS.
100 DOUBLE PAGE MAPS.

Address **Subscription Department,**

DODD, MEAD & COMPANY, Publishers, 753 & 755 Broadway, New York.

THE CUSHMAN KEY DRILL CHUCK.



This is an improvement over all other chucks of its class and is fully guaranteed.

	DIAM. HOLDS	PRICE
No. 1,	2 in. 0 to ½ in.	$6.50
No. 2,	2½ in. 1-64 to ⅝ in.	8.00

Sold by the trade and Manufactured by THE CUSHMAN CHUCK CO., Hartford, Conn.

THE AMERICAN BELL TELEPHONE CO.

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

ESTABLISHED HALF A CENTURY.

MARVIN'S FIRE & BURGLAR SAFES

HAVE MANY PATENTED IMPROVEMENTS NOT FOUND IN OTHER MAKES THAT WILL WELL REPAY AN INVESTIGATION BY THOSE WHO DESIRE TO SECURE

THE BEST SAFE

MARVIN SAFE CO.

NEW YORK, PHILADELPHIA, LONDON, ENGLAND.

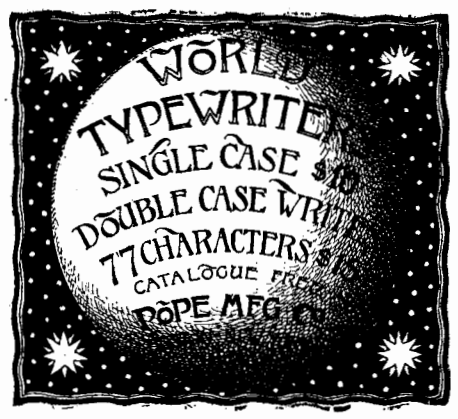
ASBESTOS PIPE COVERINGS
Made entirely of ASBESTOS.
Absolutely Fire Proof.
BRAIDED PACKING, MILL BOARD, SHEATHING, CEMENT, FIBRE AND SPECIALTIES.
CHALMERS-SPENCE CO., FOOT E. 8TH ST., N. Y.
BRANCHES: Phila, 24 Strawberry St. Chicago, 86 E. Lake St. Pittsburg, 37 Lewis Block.

NATIONAL FILTER
SPECIAL SIZE TO FILTER ENTIRE SUPPLY OF WATER FOR HOUSE. GUARANTEED TO PRODUCE
BRIGHT SPARKLING WATER
LABEL CLEANED IN 10 MINUTES.
LARGE SIZES FOR MILLS AND WATER WORKS.
NATIONAL WATER PURIFYING CO.

SYRACUSE MALLEABLE IRON WORKS
W. B. BURNS PROP'R

ELECTRO MOTOR. SIMPLE, HOW TO make. By G. M. Hopkins.—Description of a small electro motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641.** Price 10 cents. To be had at this office and from all newsdealers.

PATENTS FOR SALE.—Steam Trap, Back Pressure Valve, and Mechanical Boiler Cleaner. Investigate. Address TAYLOR BROS., New Orleans, La.



KEY SEATING Machines and 20" Drills. W. P. DAVIS, Rochester, N.Y.

THE Scientific American

ESTABLISHED 1846.

The Most Popular Scientific Paper in the World.

Only $3.00 a Year, including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete List of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
361 Broadway, New York.

THE Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies 10 cents. Address and remit by postal order, express money order, or check,

MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid **Magazine of Architecture,** richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers,
361 Broadway, New York.

PRINTING INKS.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila., and 47 Rose St., opp. Duane St., N. Y.

© 1889 SCIENTIFIC AMERICAN, INC.